



## The state of climate response in India



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# Foreword

## Deloitte



Climate change is no longer a future possibility; it is a present reality that is impacting communities, markets and ecosystems throughout India. With its economy now at US\$3.9 trillion, India is pursuing a bold vision to grow into a US\$32.4 trillion economy by the year 2047, guided by the goals of *Viksit Bharat*. Achieving this goal will require investments in infrastructure, technology and social systems. This large-scale build-out is estimated to generate 5 million new jobs by 2030 and could unlock US\$3.5–4 trillion in yearly economic output, accelerating India's transition towards a more inclusive and climate-resilient economy. Yet our growth pathway cannot replicate the carbon-intensive trajectories of developed economies. India is at a pivotal moment to *"bend the curve"* and chart a model of progress that is both climate-resilient and balances economic ambition with environmental stewardship.

This is an economic opportunity and a social responsibility. By embedding adaptation and resilience into every stage of planning and investment, India can demonstrate that large-scale development and ecological stewardship are mutually reinforcing pillars of sustainable prosperity. Such an approach offers

*a blueprint for the broader Global South*, showing how countries can pursue rapid growth while maintaining a low-emissions, climate-aware trajectory.

India's strength also lies in designing population-scale systems that combine innovation, inclusion and efficiency. Using interoperable digital infrastructure, data-driven systems and AI-enabled solutions can break silos, reduce costs and accelerate coordinated, evidence-based climate action across sectors.

For India's corporate sector, this moment calls for growth that goes beyond business performance, towards a model of resilient growth that places risk awareness, adaptive planning and social inclusion at its core. Businesses must deepen risk modelling to craft robust adaptation

strategies in high-stress zones, integrate climate considerations into long-term investment and innovation decisions and rewire value chains to withstand emerging shocks. Companies can enhance community resources, support suppliers and create integrated solutions to build resilient ecosystems that benefit both business and society.

This report is intended to guide those very conversations. By drawing together data, insights and best practices from across sectors, it seeks to provide a shared evidence base to shape India's path forward. Our hope is that it will spark collaboration, inform strategic choices and inspire leadership, helping India prove that climate resilience and economic transformation can advance hand in hand.



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# Foreword

## Rainmatter Foundation

The last few years have brought the climate and planetary crisis to every doorstep. Every region, every country, every industry and every part of the economy has felt its impact in some way. More recently, we just crossed the seventh of the nine planetary boundaries that scientists have been tracking. The need for urgency in climate action and in limiting and recovering from the damage caused cannot be emphasized enough.

India is one of the largest and fastest-growing economies in the world, and it also needs to lift many out of poverty and into the next level of economic prosperity. It is also one of the countries predicted to be most vulnerable to the impacts of climate change. And so it is imperative that we recognise the risks posed by climate change and the connected crises and spot and solve proactively for the blind spots it is rapidly exposing.

For generations, societies have depended on nature to provide raw materials and sustain industries, often without fully appreciating the value of the ecosystems that make this possible. Today, these natural systems are under significant strain, and disregarding their limits could lead to serious consequences for individuals, communities and economies.

There is a growing awareness of the deep interconnections that span geographies, industries and domains. Yet, in the relentless pursuit of efficiency and growth, focus has narrowed to such an extent that the broader picture is often overlooked. Many risks now lie hidden in the links that have faded from view, especially as specialisation continues to increase.

Deloitte's role as a strategic advisor to industry players across geographies, domains and governments affords it a deep understanding of a wide cross-section of the real world. At the Rainmatter Foundation, we started with exploring and understanding intersections and trade-offs across various facets of our lived realities that led to outcomes such as the climate and biodiversity crises, a weakening of natural assets and various dimensions of the linked human crises across the country. The coming together of these organisations and a wide variety of partners helped us understand where we are as a country, where action is needed the most and where we have already seen strides made.

Thankfully, on many fronts, government, civil society and businesses have led from the front and created some really wonderful examples of change that inspire and create hope. However, we have realised through the research and

consultations done for this report that there are ways to go with respect to what's really needed to have any hope of meaningfully addressing the crisis we are in. We cannot continue to look at sustainability and climate action in terms of a separate, siloed bucket different from the core of our businesses or activities - we have to solve the trade-offs we make in those ground up and design up. The action needs to be imagined in terms of sourcing, materials, how we view the product mix and lifecycles, and how hard we drive efficiency across the spectrum. We need to embrace the idea of resilience as a core focus rather than the singular metric of growth that ignores the clear and present risks to not just the upside, but the very existence of many businesses. It was also alarming that many central banks across the world, numerous actuaries and other risk managers are already chasing a better

understanding of this. Still, in mainstream business planning and operations, as well as in the investment world, this is not yet a significant consideration, except in pockets.

The years ahead will force a change in this approach, and it is clear that the coming decades will belong to those preparing early and even identifying opportunities for antifragility amidst these crises. There will be a huge shift in the level of complexity businesses and governments will need to manage, but given that today we possess the tools and technologies to manage and analyse mammoth amounts of data, there is reason to imagine that many will rise to the challenge and reimagine and recreate the methods, processes, industries and economies in a manner that is more in sync with the planet than we have ever seen in modern human history.



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## Executive summary

India stands at a critical inflection point in its development journey. As India charts its path ahead, climate risk must be recognised as a core economic concern. According to Deloitte's Turning Point research, if India pursues rapid decarbonisation and climate action, it could gain nearly US\$11 trillion in economic value by 2070. In contrast, failure to act could result in a loss of up to US\$35 trillion.<sup>1</sup>

Climate risks are no longer distant threats; they are present and intensifying, manifesting through deteriorating air quality, erratic rainfall, depleting freshwater reserves, increasing waste volumes, rising temperatures and more frequent extreme weather events, such as floods and landslides. These impacts are being felt across both rural and urban landscapes, driving biodiversity loss, disrupting vital natural ecosystems and threatening nutritional security.

Given the high exposure to climate risks and its status as the world's fourth-largest economy<sup>2</sup>, India occupies a central role in global climate action. Today, no meaningful

conversation on climate change can take place without keeping India at the centre. Its ambitious climate vision, spanning renewables, biofuels, decarbonisation and sustainable infrastructure, supported by a strong regulatory framework, aims to balance growth with climate resilience. According to Deloitte's report *The climate response: Tapping into India's climate and energy transition opportunity*, achieving this vision will require an estimated US\$1.5 trillion by 2030.<sup>3</sup> Such an investment can unlock pathways to cut emissions, generate jobs, and safeguard communities.

This large-scale build-out is estimated to generate 5 million new jobs by 2030. The investments would drive large-scale employment across sectors, including feedstock aggregation, production, warehousing and logistics, creating both direct and indirect opportunities. Overall, it could unlock US\$3.5–4 trillion in yearly economic output, accelerating India's transition towards a more inclusive and climate-resilient economy.

Realising this vision depends on a deeper understanding of the environmental systems that shape India's climate reality. The report, thus, helps examine the climate landscape through the lens of three interconnected environmental spheres: the atmosphere, hydrosphere and lithosphere. Each sphere, with its own set of indicators, together forms the foundation of environmental conditions, societal engagement, collective well-being and economic impact.

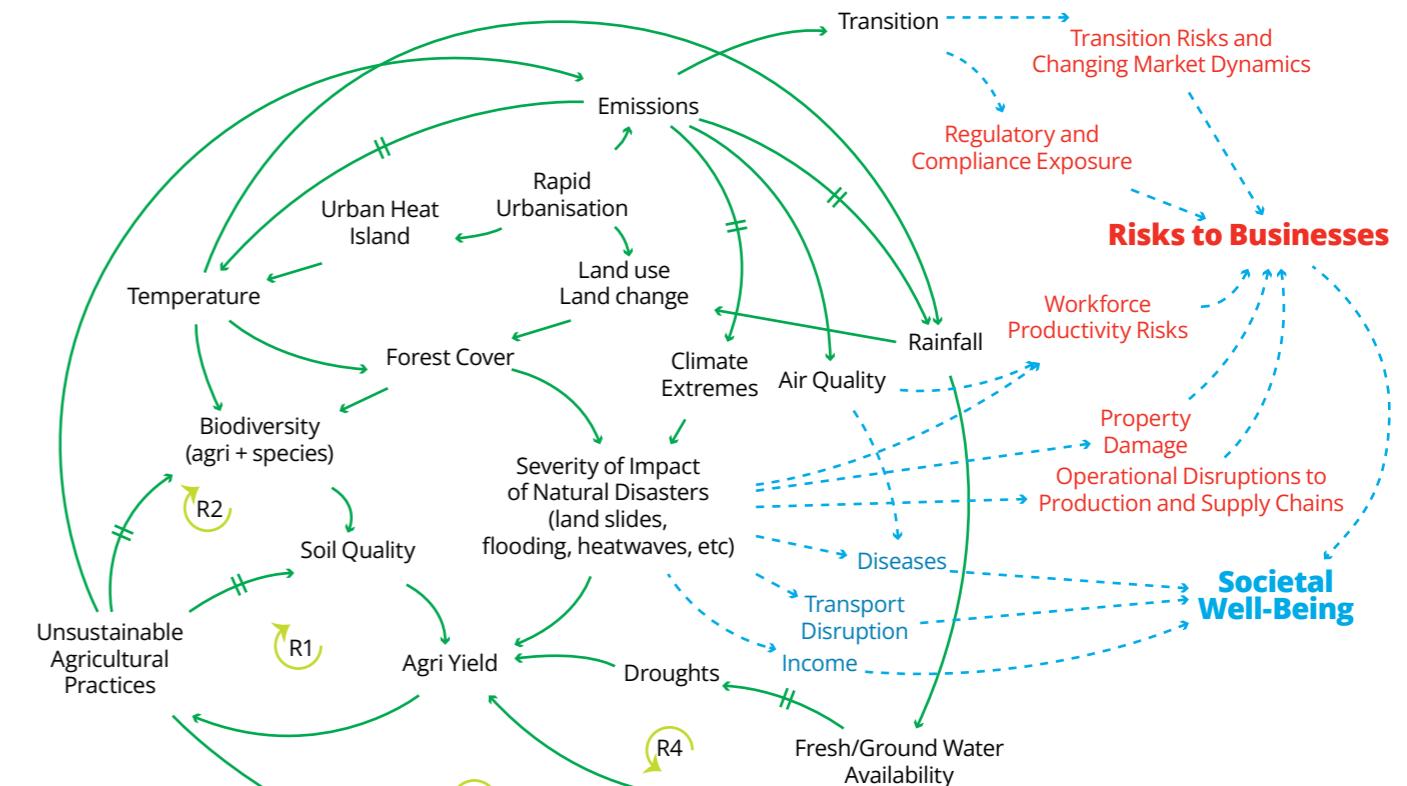
## State of climate in India

Atmosphere	Hydrosphere	Lithosphere
<b>Heat</b>	<b>Groundwater</b>	<b>Forests &amp; biodiversity</b>
• 4-7x increase in heatwave days by mid-century can be potentially experienced by major Indian cities	• Groundwater <b>recharge dropped ~13 percent</b> over the last two decades	• Decline in forest cover inside recorded forest areas of ~11,000 Sq km across states over the past decade
<b>Rainfall patterns</b>	<b>Rivers</b>	• Eco-sensitive Western Ghats and Northeast lost ~3,190 km <sup>2</sup> forest in a decade
• Monsoons are increasingly <b>erratic and unpredictable</b>	• About 15 states report reservoir levels below the 10-year average	<b>Agricultural resources</b>
• Extreme rainfall events surged ( <b>~1.4x in the last five years</b> )	<b>Glaciers</b>	• Agricultural <b>land share declined</b> , but yield rose by ~49 percent in 20 years
• Delayed monsoon withdrawals disrupting agriculture ( <b>~55 percent rainfed</b> )	• Himalayan glaciers have <b>lost over 40 percent of their area</b> and mass since the 20th century	• Fertiliser use also rose by ~49 percent
<b>Air quality</b>	• Glacier-fed water <b>spread area rose ~30 percent</b> between 2011 and 2024	• About 50 percent of soils show 'Low' organic carbon levels
• India is the <b>third most polluted country</b>	<b>Oceans and seas</b>	<b>Urban infrastructure</b>
• PM2.5 levels are <b>~8x above WHO limits</b> ; 80 percent of cities lack air quality monitoring stations	• Since 1950, sea surface temperatures in the Indian Ocean have risen by ~1.2°C	• <b>Built-up land expanded ~31%</b> (2006-2023)
	• Arabian Sea <b>cyclone frequency rose by ~52 percent</b> in the past two decades	

These climate indicators are **deeply interconnected, creating compounding pressures across systems**. Changes in the atmosphere influence rainfall and temperature patterns; water availability affects land use and soil health; and land degradation increases vulnerability to floods and erosion. Further, loss of biodiversity and ecosystem degradation weaken natural buffers, reducing the ability

of ecosystems to provide essential services and increasing the cost of adaptation. The map below illustrates these cause-and-effect relationships, showing that India's climate challenge involves more than isolated shocks. It represents a systemic transformation unfolding across regions, sectors and communities, with cascading impacts on businesses and societal well-being.

## Climate in motion: Mapping the web of systemic impacts



|| - Time Delay between the cause and the effect

R - Reinforcing Loop (The behaviour of the system is amplified in one direction)

Dashed lines - Causal pathways showing impacts on people and businesses

Blue - Impacts to people

Red - Impacts to businesses

This evolving climate landscape calls for **coordinated, systems-based responses**. Hence, governments, policymakers, corporates, civil society groups and city planners must move beyond siloed interventions, **adopting a systematic approach** to assess risks and design integrated responses that anticipate cascading risks and create co-benefits.

**Equally important is understanding how citizens perceive and respond to climate change**, as individual behaviour affects both policy and market outcomes. Deloitte's Citizen Climate Survey 2025, covering over 1,700 households across India's diverse climatic zones, examines how people understand and experience climate change, and how limited access to resources and support mechanisms continues to shape their ability to adapt.

The findings reveal that the burden of climate impacts is unevenly shared. Women (37%) report higher rates of severe impact than men (30%), underscoring gendered vulnerabilities linked to care responsibilities and unequal access to resources. Climate change tends to reinforce existing gender inequalities, as both its impacts and the responses that follow often perpetuate existing social and structural disparities. Similarly, those aged 35–44 face the most pronounced impacts (40%), likely due to greater livelihood and family responsibilities, while younger adults (18–24) are less affected (26%).

In the Himalayan regions, the most frequently reported climate concerns are erratic rainfall (49 percent) and rising temperatures (40 percent). These also remain key issues in the Northeast, alongside a heightened incidence of flooding (38 percent), with rising temperatures (54 percent) and erratic rainfall (39 percent) among the top concerns reported.

As these individuals are both customers and employees, companies need to assess the risks arising from shifts in customer behaviour and purchasing power. At the same time, evolving societal expectations are placing greater emphasis on businesses to take a proactive role in addressing climate change.

Climate change also poses direct risks to business operations and growth. Extreme weather events disrupt supply chains, reduce workforce productivity and damage physical assets. At the same time, transition risks, such as carbon regulations and investor scrutiny, are reshaping markets. Climate risks vary by sector, with each of the sectors facing unique vulnerabilities based on geographic location, resource dependence, operations and value chain. Some industries face immediate, direct consequences (first-order effects), while others experience indirect, cascading impacts (second-order effects). Recognising these sector-specific exposures is critical for designing targeted adaptation strategies.

## Citizen Climate Survey 2025 findings: Living the climate impact

### Feeling the impact

**86%**

report experiencing climate change effects, with **1 in 3** describing them as "significant"



cite rising temperatures as top concern

**37%**

**of women and 40% aged 35 - 44** report higher exposure

### Climate stresses reported

**34%**

report health and livelihood losses (crop/livestock)

**51%**

of landowning farmers report crop loss as their main impact

### How people are adapting

**44%**

practice waste segregation

**40%**

cut back on electricity and water use

**30%**

cut single-use plastics

**Yet 22% of respondents remain inactive, indicating a gap in climate awareness and action.**

### Barriers to action

**33%**

believe **individual actions** make little difference

**30%**

**call for subsidies** or incentives

**25%**

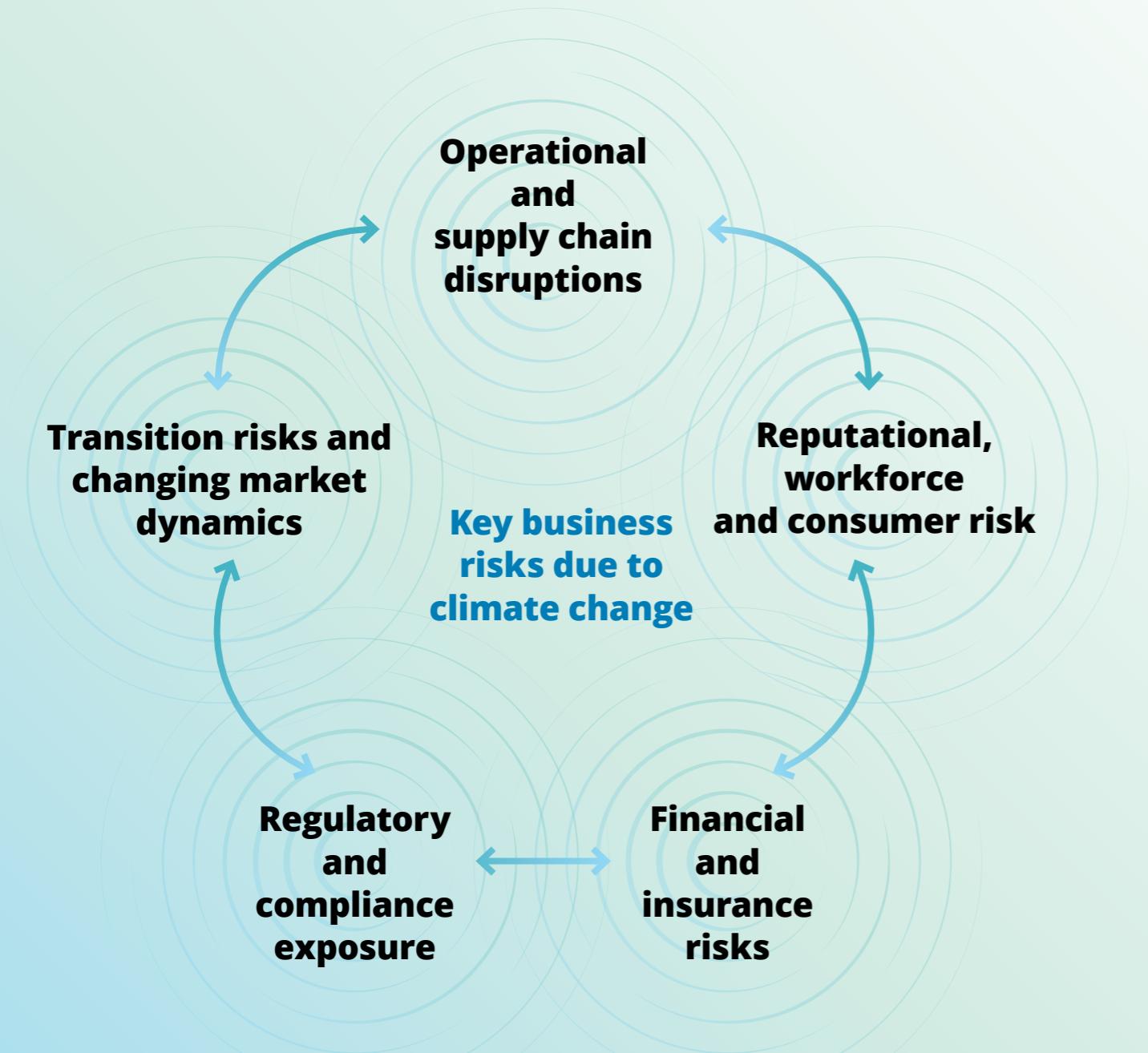
**seek better awareness** and access to information

### Ready to collaborate

**77%**

willing to join community-driven climate initiatives

## Key business risks due to climate change

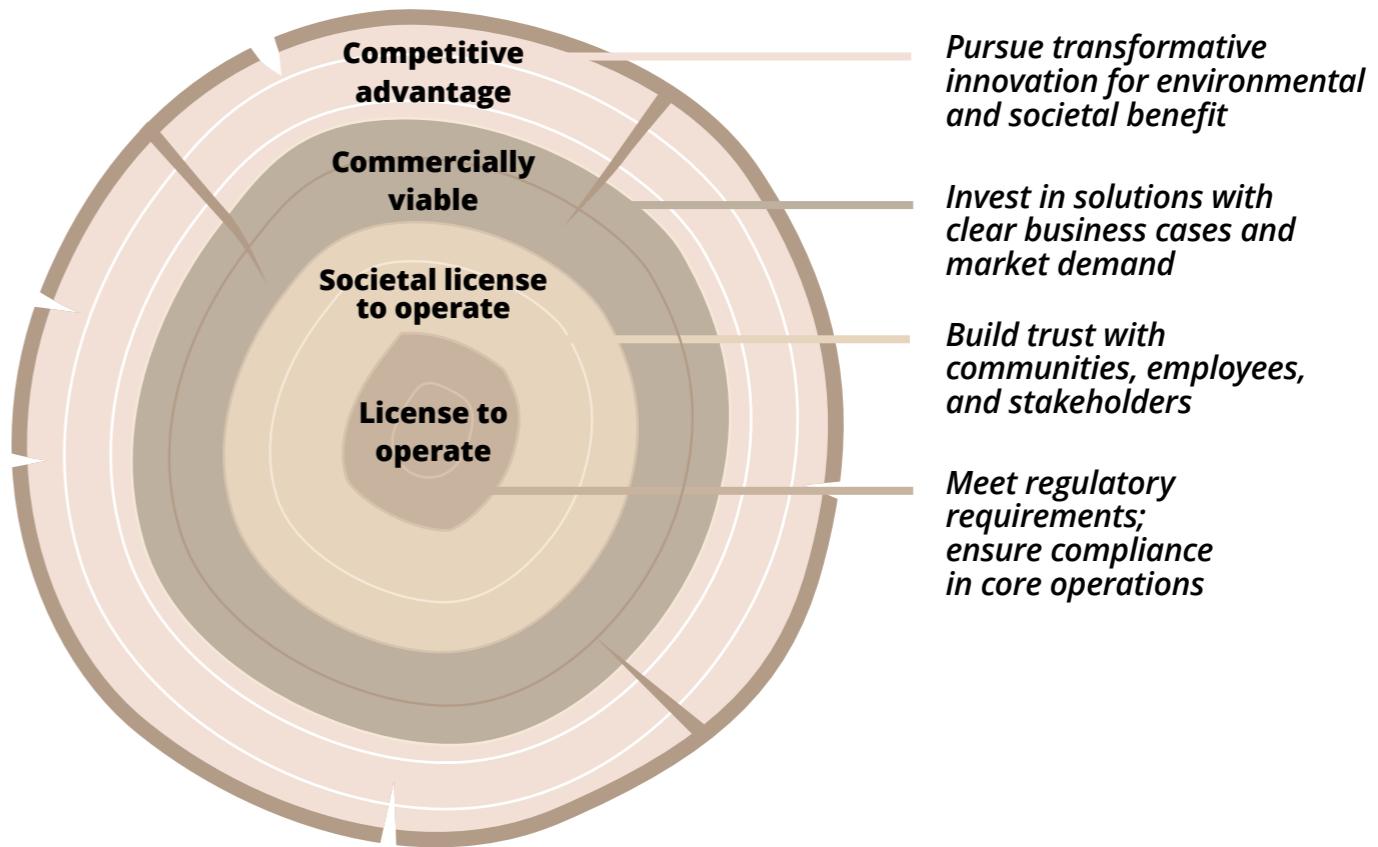


While mitigation helps address the causes of climate change, adaptation tackles its immediate impacts, making it critical for protecting lives, infrastructure and economic stability. A WRI study shows

every dollar invested in adaptation can yield over US\$10 returns, positioning climate resilience as a smart economic opportunity for businesses and investors.<sup>4</sup>

Harnessing this opportunity requires businesses to embrace an integrated approach that strengthens core operations, rewrites value chains and invests in shared community resources. This layered model protects enterprise value, builds systemic resilience and unlocks new avenues of growth that can be effectively guided through a corporate climate action framework.

## Corporate climate action framework



Recognising the opportunities presented by climate action, businesses are moving from intent to action. Deloitte's **Corporate Climate Readiness Survey 2025**, which engaged more than 50 leading corporates across sectors, offers a candid view of how Indian businesses are navigating a changing climate. The results reveal that climate risk has moved to the centre of strategy, shaping how organisations plan, operate and grow.

Nearly **84 percent** of respondents say climate change is already influencing their decisions, with **one in six** reporting a significant impact. Looking ahead, over a third of respondents expect this influence to grow in the next three years, underscoring companies' view of climate risk as a pressing, fast-moving challenge.

The nature of that reality is both physical and operational. **Extreme heat and water stress** top the list of concerns, followed by **flooding, sea-level rise and poor air quality**. These pressures are disrupting production, straining supply chains and impacting workforce health, highlighting that business continuity now hinges as much on resilience as on performance.

While **operational disruption** remains the most visible challenge, gradual pressures, too, are emerging, such as shifting regulations, evolving consumer expectations and workforce wellbeing concerns. These are now surfacing in financial terms through **rising insurance costs and tighter access to capital**. Resilience, it appears, now carries a price tag.

**Despite these pressures, investment in climate action is increasing**, reflecting a growing understanding that sustainability drives growth, innovation and long-term competitiveness.

Nearly two-thirds plan to increase climate-related investments over the next three years, with some anticipating **substantial growth of over 20 percent**. While efforts often remain fragmented, many firms are working closely with suppliers, regulators, customers and financial stakeholders to build resilience, innovate low-carbon solutions and future-proof their value chains.

However, building resilience at the corporate level is only part of the equation; **meaningful climate action also requires national-scale coordination and innovation**. India, as a nation, has the tools, talent and tenacity to lead in **climate resilience and green innovation**.

**The government** is taking critical steps through climate policies and action plans at both the Central and state levels.

**Start-ups** are driving breakthroughs in climate-tech, from waste management to precision agriculture. **States and cities** are piloting climate-smart agriculture, green infrastructure and circular economy models. **Forward-looking businesses**

are embedding sustainability into core operations and supply chains, while Public-Private Partnerships (PPPs) are beginning to unlock scale. **Civil society, an equally important actor, is playing a vital role in mobilising grassroots awareness, driving behavioural change, strengthening accountability**, bridging the last-mile gap in adaptation, supporting the development of infrastructure for the climate action ecosystem and guiding policy action.

## Corporate Climate Readiness Survey 2025

### Key findings

#### Climate impacts businesses



84%

say climate change already impacts business strategy and operations



64%

plan to increase climate-related investments in the next three years



72%

report operational disruption as the most significant business impact



54%

cite extreme heat and water stress as top operational challenges

#### Businesses are facing operational, financial and workforce risks due to climate-related events

47%

cite employee health challenges driven by changing environmental conditions

44%

report changing consumption patterns and regulations affecting operations

21%

cite increased insurance costs or lack of insurance availability

28%

say they are supporting innovation to drive new climate solutions

41%

respondents are building climate risk mitigation and adaptation capabilities

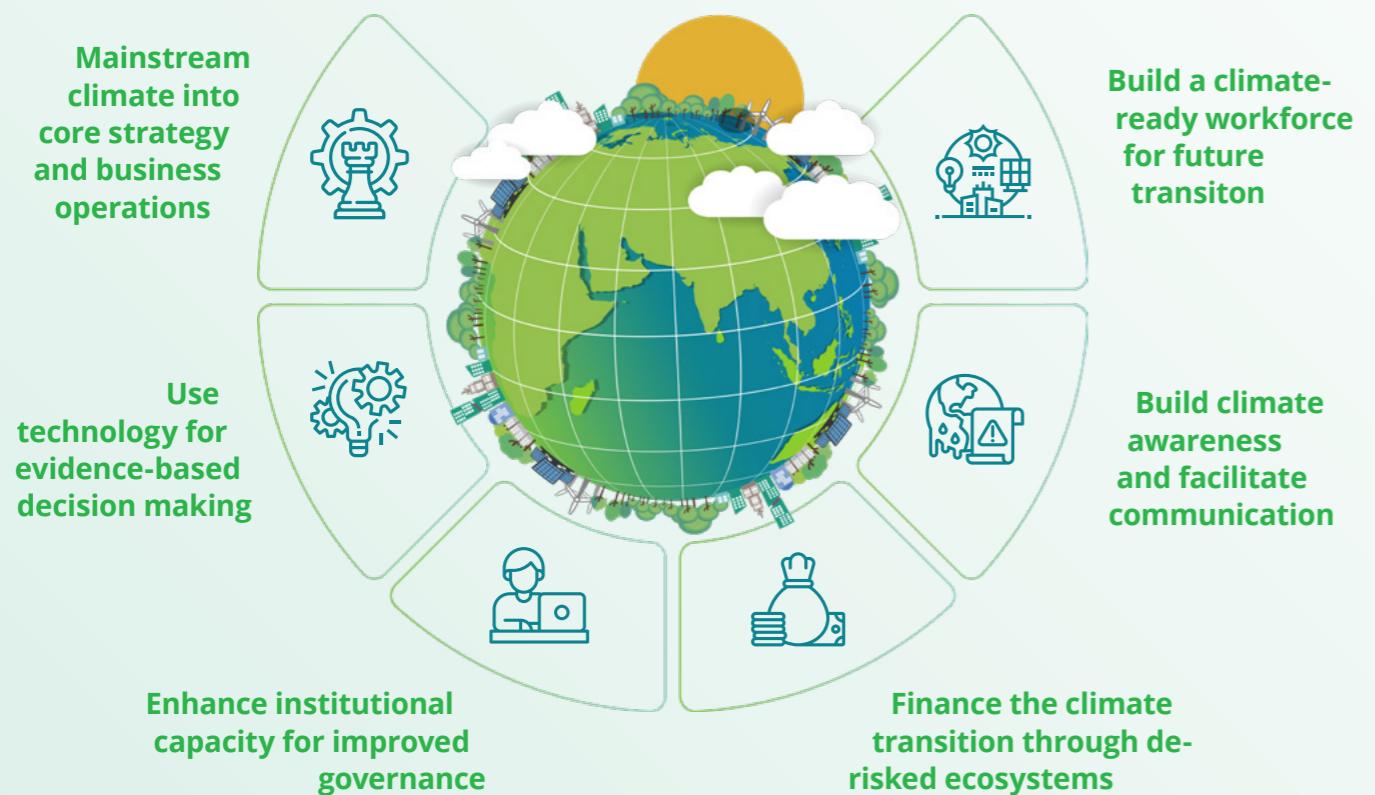
40%

are setting standards, specifications, and guidelines to strengthen industry alignment

38%

are collaborating with government and civil society to advance climate action

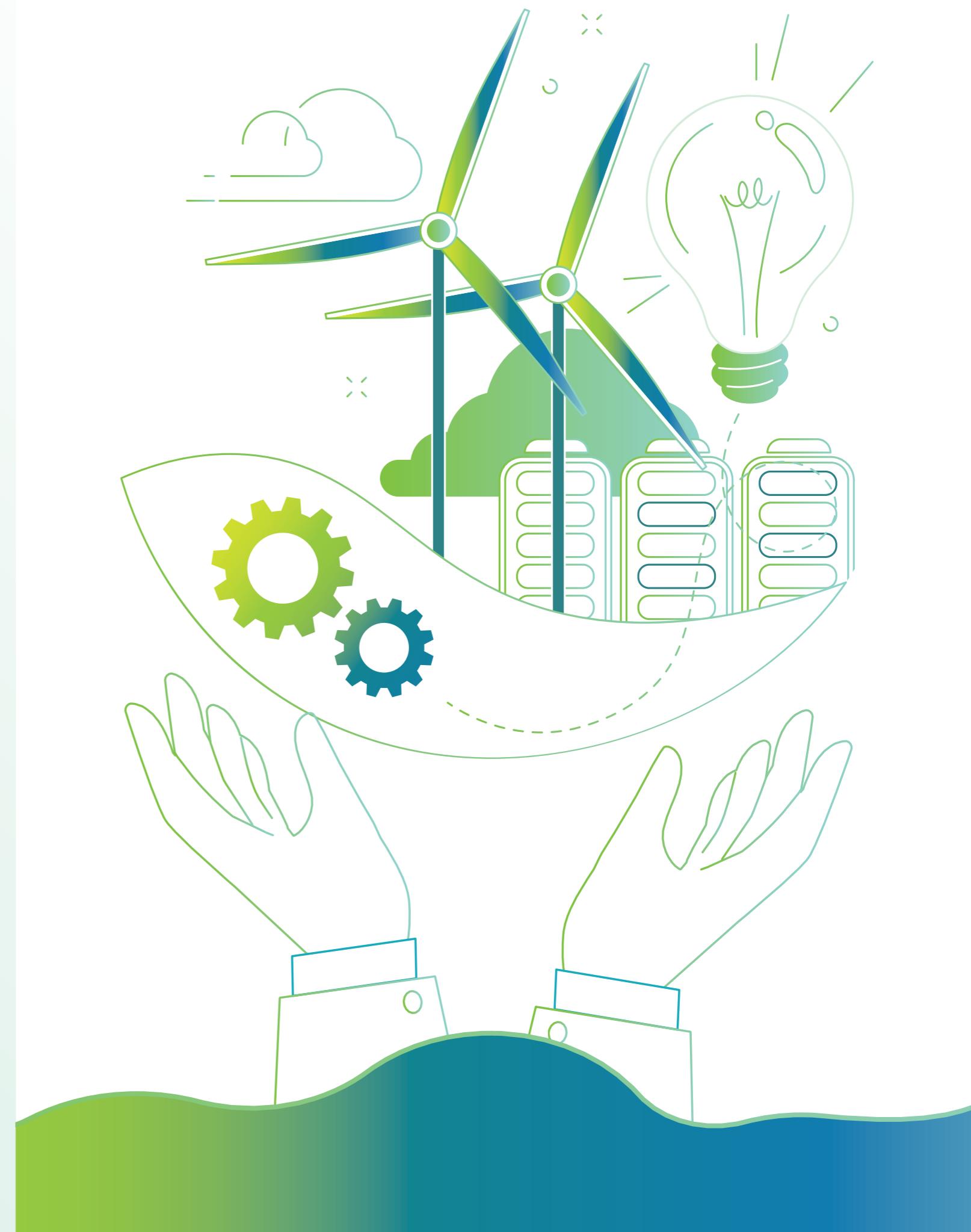
## Call to action: Pathway to climate resilience



Protecting and enhancing ecosystem services can serve as the unifying agenda for these stakeholders, ensuring that climate action also rebuilds India's ecological wealth.

**Systems thinking provides a framework to understand climate risks holistically. It highlights the connections between environmental, social and economic systems. However, these initiatives will only create a scalable, tangible impact when combined with coordinated action from government, industry, financial institutions, civil society, research, academia and communities.**

This includes aligning policies, integrating climate risks into planning and providing greater support for local institutions. For businesses, it means moving beyond Corporate Social Responsibility and embedding sustainability into their core operations, supported by data, talent, systems and community engagement for a just and lasting transition. The effectiveness of these efforts will shape India's resilience in the coming decade. The choices made today will determine the nation's ability to withstand climate shocks, protect vulnerable communities and safeguard critical ecosystems, turning the climate challenge into an opportunity for sustainable, resilient growth.





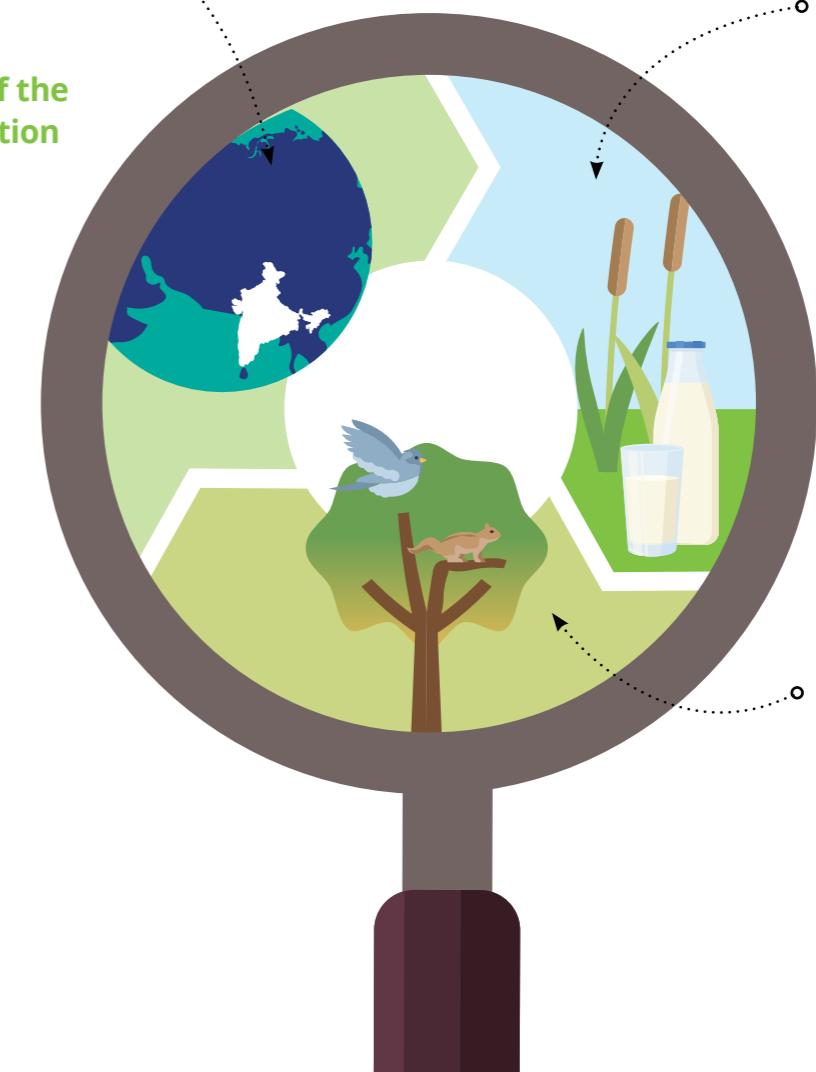
# State of climate in India

Climate change is a global issue, but its impacts are felt locally and disproportionately. India stands at a defining moment in the global climate narrative, both as one of the most vulnerable nations to climate impacts and as a country whose response would shape the trajectory of its development for decades to come.

With its vast and varied geography, densely populated urban centres, high agricultural dependence and rich biodiversity, it faces a unique and complex set of climate risks. As the world's fourth-largest economy and home to nearly one-sixth of humanity, India's climate decisions carry global significance, influencing the course of global sustainability efforts.

India faces an acute climate crisis, given its scale of people and limited resources<sup>4,5,6,7,8,9</sup>

India holds ~4 percent of the world's freshwater resources but supports ~20 percent of the global population



India is among the top three global producers of food, leading in pulses, spices and milk and ranking high in rice, wheat, fruits and vegetables

India, covering 2.4 percent of the world's land, hosts 7-8% of global biodiversity share, and is home to 4 of the world's 36 biodiversity hotspots

## India's Viksit Bharat@2047 is at risk without effective climate action<sup>10,11</sup>

**US\$3.9 T** India's GDP  
Indian economy in 2024

**US\$32.4 T** India's projected GDP  
Indian economy under  
Viksit Bharat @2047

**1,395 kWh** per capita energy demand

**3.4% of GDP** infrastructure spending

**4,000 kWh** 3 times of current per capita energy demand

**7% of GDP** infrastructure spending targets under the National Infrastructure Pipeline initiative

To achieve the Viksit Bharat@2047 vision, India will need to sustain large-scale investments in infrastructure and industrial growth, driving up energy demand and emissions footprint. Ensuring this pathway remains resilient - balancing economic progress with sustainability will be critical, moving beyond a narrow focus on financial goals alone

**If climate action is not integrated into India's growth strategy, the country risks falling short of its GDP ambitions**

### 33 percent

of GDP is generated in sectors that are highly dependent on nature, including forestry, agriculture, aquaculture, food, beverages, tobacco, hydropower, etc.

### 2.8 percent

estimated impact on GDP due to drop in agricultural output, equivalent to a 16 percent drop in agricultural output by 2050

### 13 percent

loss of GDP by 2050  
Cumulative estimated impacts on India's GDP from climate change (if high emissions continue)

Uncontrolled climate change poses a significant threat to decades of economic progress and could jeopardise India's status as a contemporary, global hub for manufacturing and services. The next frontier is resilient-led growth, where companies pursue expansion while embedding climate resilience at the core of strategy. From safeguarding supply chains to future-proofing assets and protecting workforce productivity, resilience is not a cost but a competitive advantage. The companies that grow with resilience would be the ones that sustain value, attract capital and secure relevance

in the decade ahead.

Achieving this, however, requires breaking away from the legacy of siloed problem-solving that has long prioritised short-term economic gains over ecological and community well-being. This has contributed to the current planetary emergency, now understood as a web of linked risks across climate, biodiversity, soil and water.

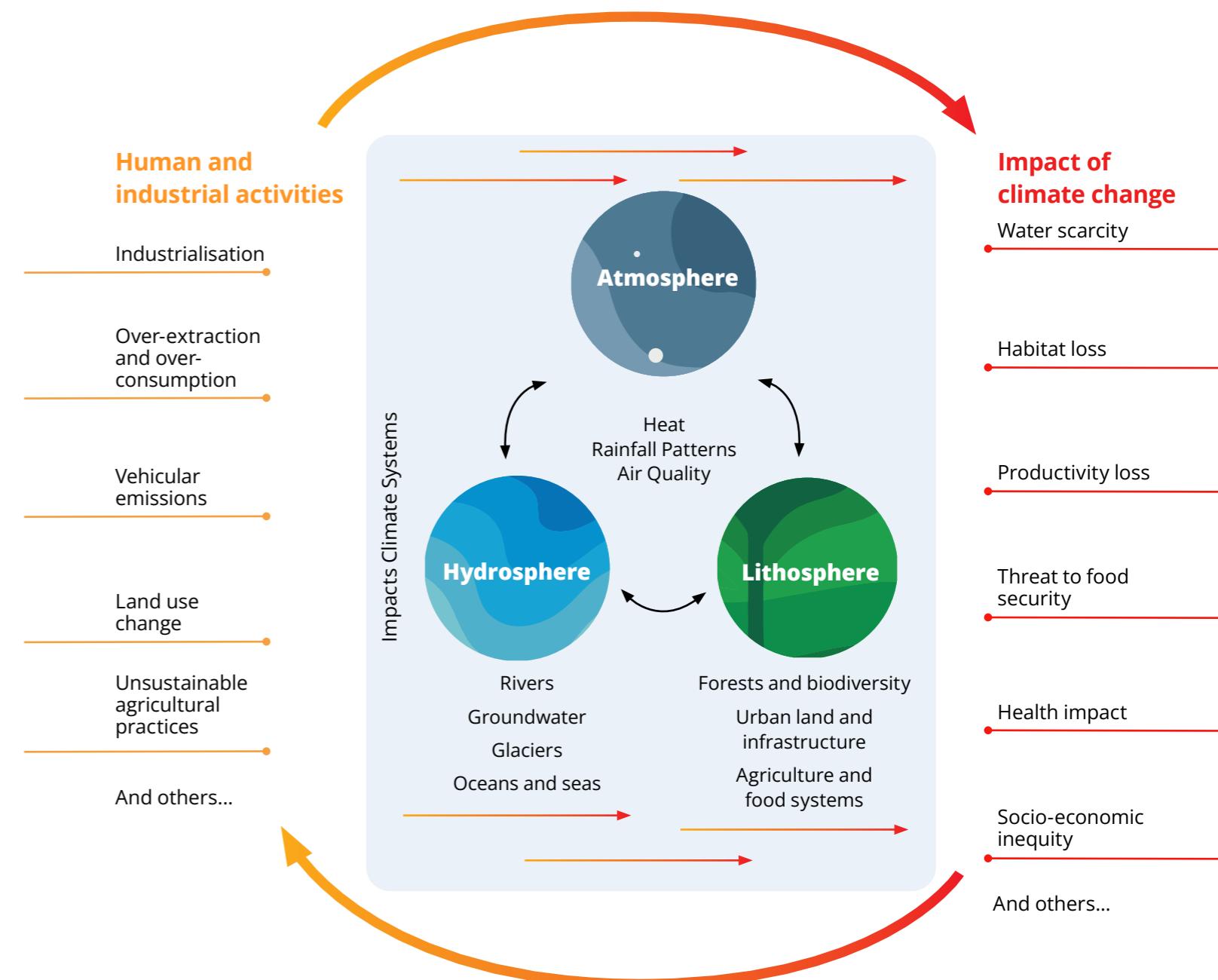
To understand the climate-related shifts more clearly, the report examines India's climate by focusing **on the atmosphere, hydrosphere and lithosphere**.

- **Atmospheric change** captures heat, rainfall patterns and air quality

- **Hydrosphere indicators** track rivers and groundwater, glacial systems, oceans and seas

- **Lithosphere shifts** reveal changes in forests and biodiversity, soil health and agriculture practices, as well as urban land use and infrastructure

## Interplay between climate systems



Today, the signs of disruption are all around. India continues to experience extreme climate events, such as devastating heatwaves that impair agricultural productivity and torrential rains leading to flooding, which affects India's infrastructure and communities. Glaciers are retreating at alarming rates.

Water tables are dropping, forests are burning and air pollution has breached safe limits across dozens of cities. **These changes signal growing stress on natural systems**, underscoring the urgent need to understand the country's climate risks through a holistic, integrated and multi-dimensional lens.

## India's climate dashboard: Tracking the pulse

**The climate dashboard aims to bring together a high-level summary of trends across key critical climate indicators to offer a consolidated view of where India stands today.**

### Climate trends in India

Atmosphere	Climate indicator	Climate trends				Insights from Deloitte's citizen survey
		① Heat	② Rainfall patterns	③ Air quality	④ Rivers	
	① Heat	<b>15-fold</b> increase in extreme heat wave days across the March to May and June to September months in the last three decades	<b>4 - 7x</b> increase in heatwave days by mid-century can be potentially experienced by major Indian cities			
	② Rainfall patterns	<b>43% increase</b> In Central India LPA, from 1110 mm (1951–2000) to 1590 mm (1971–2020)	<b>4% decrease</b> in East and Northeast LPA, from 2036 mm (1951–2000) to 1951 mm (1971–2020)	<b>1.4 times</b> Rise in extreme rainfall events in the last 5 years	<b>Delayed monsoon withdrawal</b> resulting in higher rainfall (~22% increase b/w Oct to Jan as compared with ~7% b/w Jun to Sept in the last four decades)	
	③ Air quality	<b>3rd</b> most polluted country in the world after Bangladesh and Pakistan		<b>~80 percent of cities / towns</b> lack air quality monitoring stations, 15 percent with ~1, 5 percent with >1		

Hydrosphere	Climate indicator	Climate trends			Insights from Deloitte's citizen survey
		④ Rivers	⑤ Groundwater	⑥ Glaciers	
	④ Rivers	<b>Below the 10-year average</b> Water reservoir levels in 15 states	<b>~4% to ~14%</b> decrease in annual rainfall across key river basins: Ganga, Brahmaputra, Cauvery, and Narmada over the past two decades compared with the last century (1901-2000)		<b>43 percent of BOD stations</b> across Indian rivers report levels above safe thresholds
	⑤ Groundwater	<b>13 percent</b> decline in recharge rates over the past 20 years.	<b>Overexploitation</b> of groundwater faced in regions such as Rajasthan, Haryana, Punjab and Delhi		<b>20 percent</b> of samples collected exceed the Nitrate limits, hinting at rising toxic contamination
	⑥ Glaciers	<b>40 percent</b>	<b>30 percent</b> loss in glacial area and mass during the 20th century	<b>65 percent</b> increase in water spread area from 2011 to 2024	Faster loss of glacier mass in the Hindu Kush Himalayas
	⑦ Oceans and Seas	<b>&gt;2.5 mm/year rise</b>	<b>60 percent</b> in sea level in parts of India	<b>52 percent</b> loss in West Bengal's coastline since 1990	increase in Arabian Sea cyclones (2001-19); very severe ones up 150 percent

Lithosphere	Climate indicator	Climate trends			Insights from Deloitte's citizen survey
		⑧ Forests and biodiversity	⑨ Soil health	⑩ Land use	
	⑧ Forests and biodiversity	<b>3,190 km<sup>2</sup> of forest cover</b> lost in the past decade across the biodiversity-rich Western Ghats and northeastern states	<b>13 states, ~11,097 fires</b> in 2024; Himachal Pradesh experienced a 6.7x increase and Uttarakhand 2.7x rise		<b>~33 percent</b> of respondents across urban and rural areas report experiencing significant climate impacts. At the same time, a considerable share, over 12 percent, reports feeling no impact.

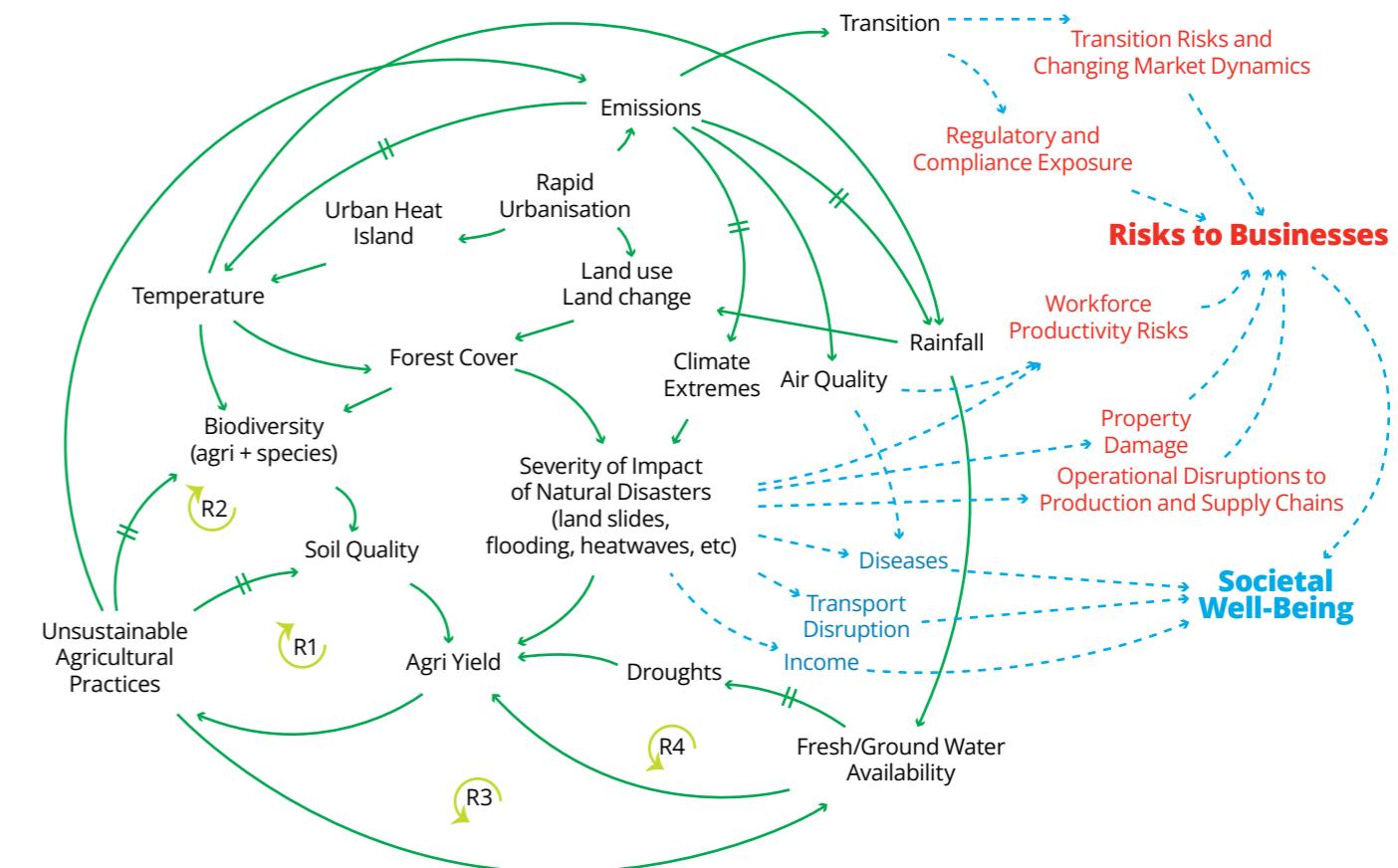
Societal indicator	Climate trends			Insights from Deloitte's citizen survey
	① Agriculture and food systems	② Urban land and infrastructure	③ Water and energy	
① Agriculture and food systems	<b>49 percent</b> in agricultural productivity mirrored with equal growth in fertiliser use (in response to shrinking cultivation areas)	<b>50 percent</b> Soil samples show 'low' organic carbon levels, due to excessive fertiliser use (high degradation in Punjab, Haryana)	<b>~80 percent</b> Of India's usable Freshwater resources is consumed by Agriculture	Nearly half of respondents are already taking adaptive steps such as waste segregation (44 percent) and cutting electricity or water use (40 percent) and almost one-third (30 percent) have reduced single-use plastics; however, 22 percent remain inactive, across urban and rural areas.
② Urban land and infrastructure	<b>31 percent</b> growth in built-up land in India (2006–2023)	<b>60 percent</b> More night-time warming in over 140 prominent Indian cities compared with non-urban areas surrounding them	<b>UHI, higher emissions, ineffective waste management</b> resulting from rapid urbanisation (growth in built-up areas, increased vehicular density, etc.)	About 34 percent of rural respondents doubt any impact from their actions (compared with about 30 percent in towns/cities), while city dwellers more frequently (31 percent) cite limited awareness compared with town (21 percent) and village (24 percent) residents.

The climate dashboard is designed to support decision-making and foster coordinated action. By bringing together environmental data and public perception, it helps create a shared language for engagement among governments, civil society, businesses and citizens. The following section offers an in-depth exploration of each indicator, examining the trends, challenges and implications in greater detail. Insights from the Citizen Survey reveal how individuals experience climate change in their daily lives, while Deloitte's Corporate Climate Readiness Survey shows that most businesses

already see it influencing their strategy and operations. Taken together, these perspectives reflect how climate change cuts across personal, social and economic spheres, affecting both people and the systems that sustain them.

It is this combination of **data-driven insight and human-centred perspective** that would be essential for designing equitable, resilient and scalable climate solutions for India. Given that its impacts are interconnected, applying an integrated approach to building such solutions would be crucial.

## Climate in motion: Mapping the web of systemic impacts well-being



|| - Time Delay between the cause and the effect

R - Reinforcing Loop (The behaviour of the system is amplified in one direction)

Dashed lines - Causal pathways showing impacts on people and businesses

Blue - Impacts to people

Red - Impacts to businesses

As illustrated above, these **cause-and-effect relationships underline that India's climate challenge is beyond a series of isolated shocks; it is a systemic transformation unfolding across regions, sectors and communities**. Unsustainable agricultural practices, for instance, degrade soil health and reduce crop productivity, triggering a self-reinforcing cycle where declining yields push farmers towards even more extractive methods, further accelerating land and ecosystem degradation.

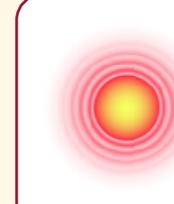
By integrating this data with systems thinking, the climate dashboard helps shift from fragmented efforts to coordinated strategies that strengthen resilience at scale. This report aims to shift the conversation from **reactive adaptation to proactive, equitable climate action**, anchoring the pathways that India must pursue to safeguard its future growth and societal well-being.

## Climate indicator 1:

### Heat

**India is entering an era of chronic heat: Climate change is leading to more frequent, deadly and economically costly heatwaves**

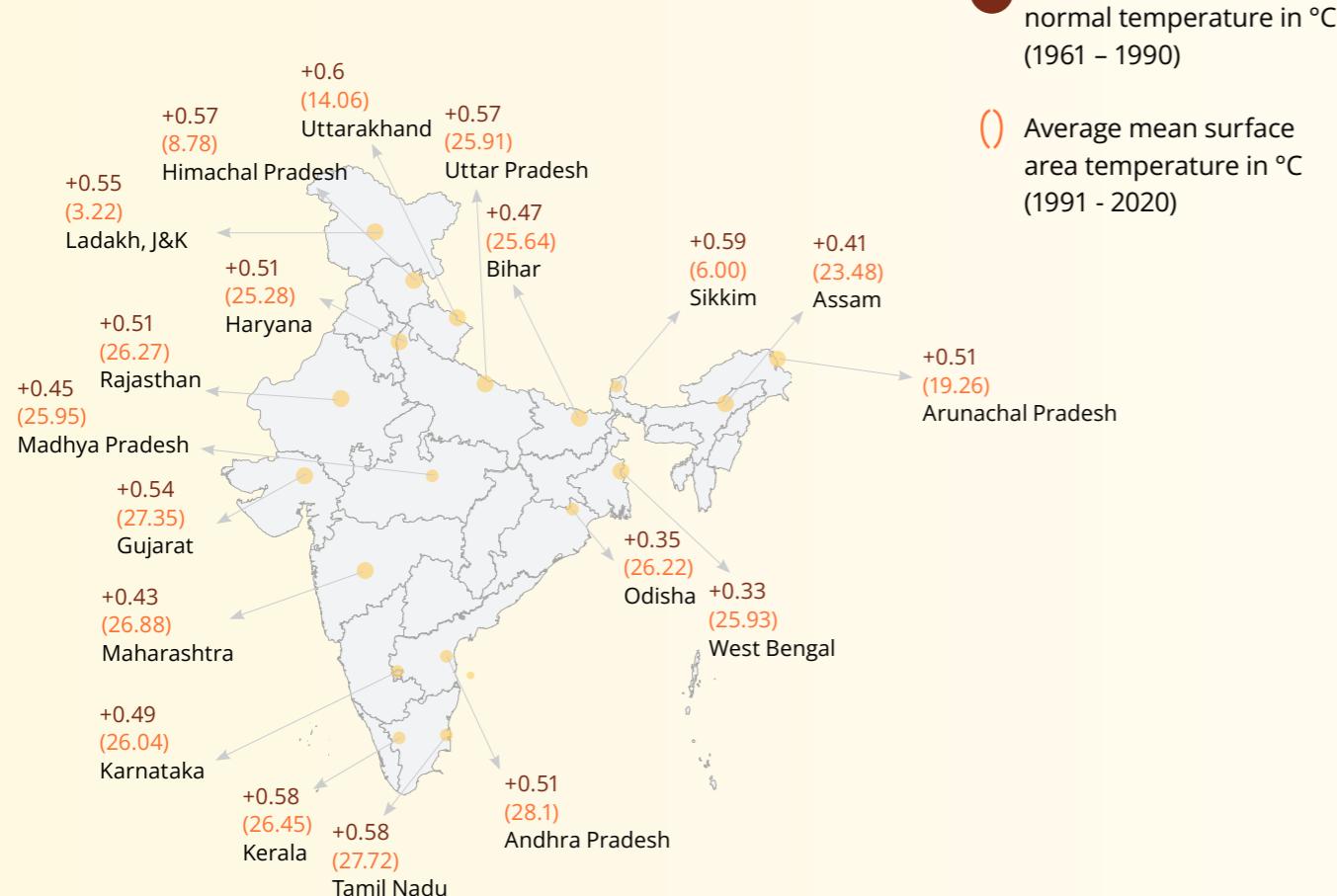
**India: A nation under heat stress** 15-fold increase in extreme heatwave days between March to September in the last 3 decades



About **75 percent** of India's workforce (~380 million) is exposed to heat stress due to outdoor or heat-intensive jobs

**The average mean surface temperature during 1991–2020 has risen across the country compared to the average of previous three decades (1961–1990)**

Average mean surface area temperature departures



**Heat stress spans India's diverse geographies - from its vast plains to its peninsular interior and its long coastlines**



**North-west India:** Frequency among the highest, many stations showing rising events, lasting 4–8 days, with uptrends across stations; **Delhi and Rajasthan:** Extreme temperatures breached 50°C in 2024, triggering widespread health emergencies.



**Central India:** Elevated frequency; pockets with 2–4 events/season, with durations spanning 4–8 days, increasing at many stations.



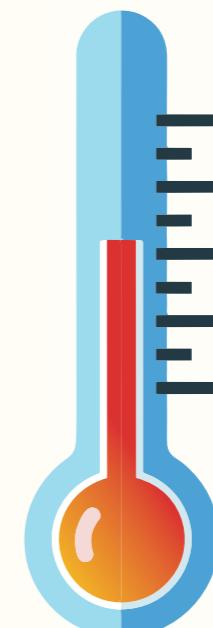
**East-Coast India:** Temperatures >40°C common, humidity amplifying heat stress, >40°C common, humidity amplified stress.



**Interior Peninsula:** Duration spans across multiple days - **~4–8 days**

**Rising heat stress is reducing labour productivity and threatening income security**

- In 2024, India recorded 48,156 heat stroke cases and 161 heat stroke deaths
- 181 billion potential labour hours were lost due to heat exposure in 2023, an increase of 50% from the 1990-1999 annual average



**Extreme heat is intensifying public health risks and imposing growing economic costs**

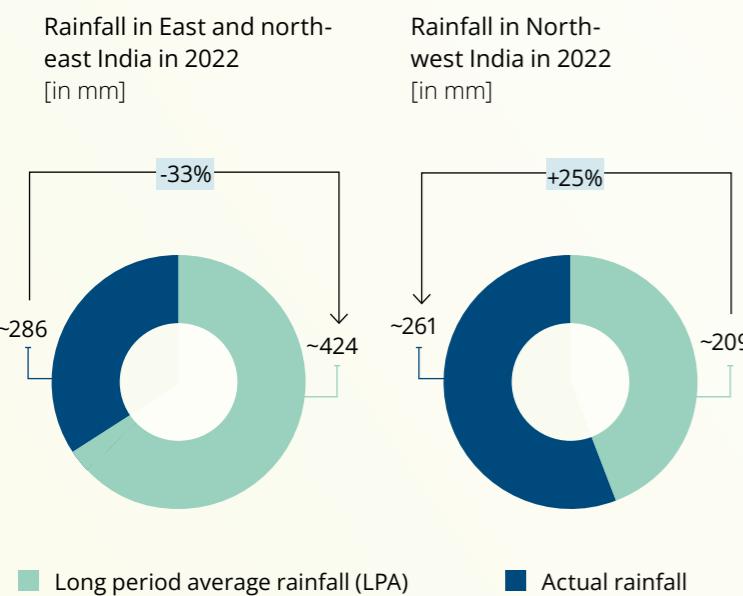
- Heat-induced productivity loss is highest in Southeast Asia.**
- By 2030, India could lose 5.8 percent of working hours
- Sectors such as agriculture, construction and transport face growing cost burdens from climate-exacerbated heat

## Climate indicator 2:

### Rainfall

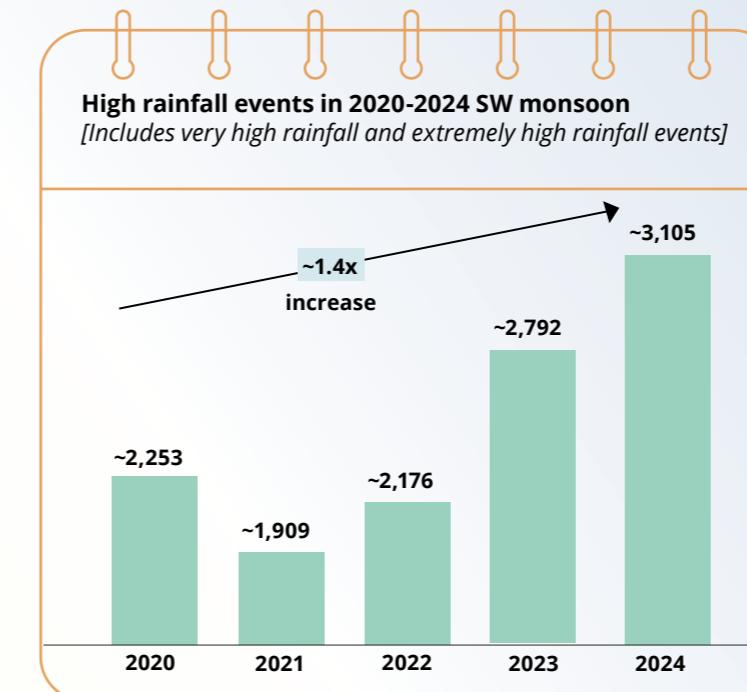
India's monsoon is becoming increasingly erratic, with shifting paths, delayed withdrawal and surging extremes

Monsoon is changing course: India's rainfall belt is drifting westward, leaving traditionally wetter regions drier



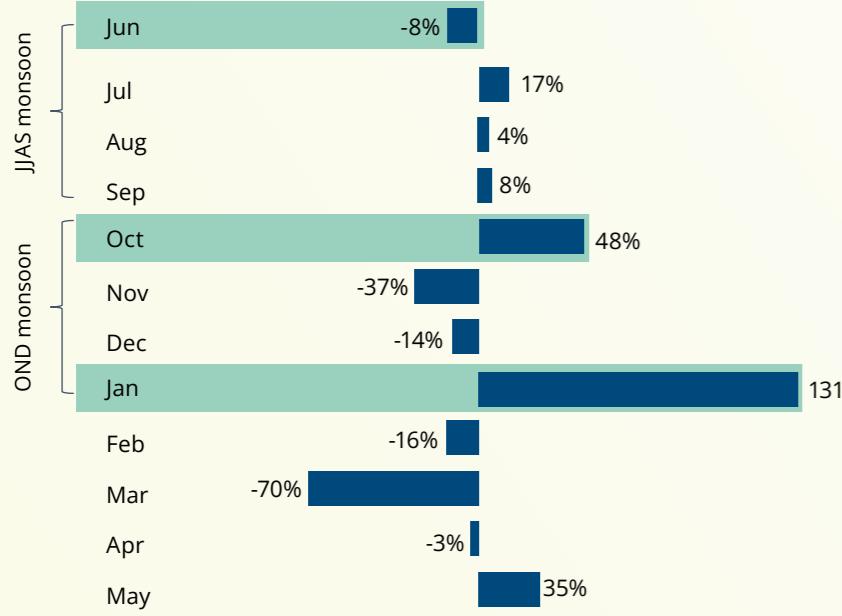
- Rains now **skewed towards western states** (Gujarat, Rajasthan, Maharashtra), receiving Higher rainfall
- Deficits seen in Indo-Gangetic Plains and Northeast, including Bihar, West Bengal and Assam
- Low-pressure systems are veering West from the Bay of Bengal, disrupting historical monsoon paths

Rainfall extremes are surging: Heavy rainfall events have risen 1.4x in five years, while dry spells persist



- About 55 percent of India's sown land is rain-fed, and highly exposed to erratic precipitation
- Extreme rainfall events have been experienced across regions, some examples include Dharali, Uttarakhand (August 2025) cloudburst, Kerala landslide (July 2024), Vijaywada Floods (September 2024) intensified by rain surge

Month-wise trends for rainfall in 2022 when compared to the long period average



Withdrawal is delayed: Monsoon rains are spilling into new months, disrupting seasonal cycles

- Southwest monsoon patterns are increasingly extending into October, indicating a shift in seasonal timelines.
- Northeast monsoon activity has been recorded as late as January, reflecting growing unpredictability in rainfall cycles.
- Excess rainfall during key harvest periods has adversely impacted crops such as rice, maize and pulses, affecting yield and quality.
- Between 2012 and 2022, 48 percent of districts witnessed elevated rainfall in October, overlapping with critical sowing and harvesting phases and disrupting agricultural operations.

Furthermore, Inadequate data systems are masking the full extent of monsoon volatility



#### Low-resolution grids

Rainfall data still captured at coarse 25 km x 25 km resolution, limiting precision in analysis and response

#### Real-time data availability

Data transmission from remote or difficult-to-access locations can be slow, potentially leading to outdated information being used for forecasts

#### Geographical coverage can vary

Geographical coverage can vary, particularly in rural and remote areas, leading to potential underrepresentation of some regions

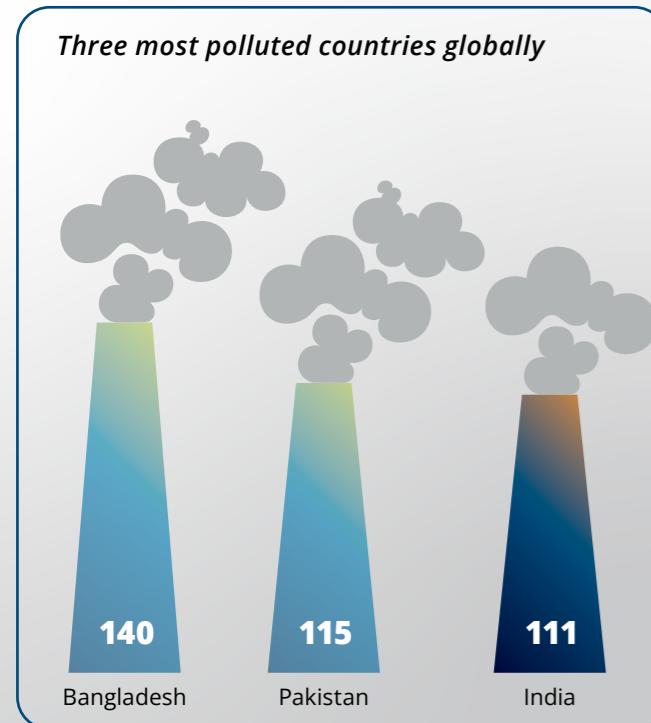
## Climate indicator 3:

### Air quality

#### Air quality crisis: A national public health and environmental risk

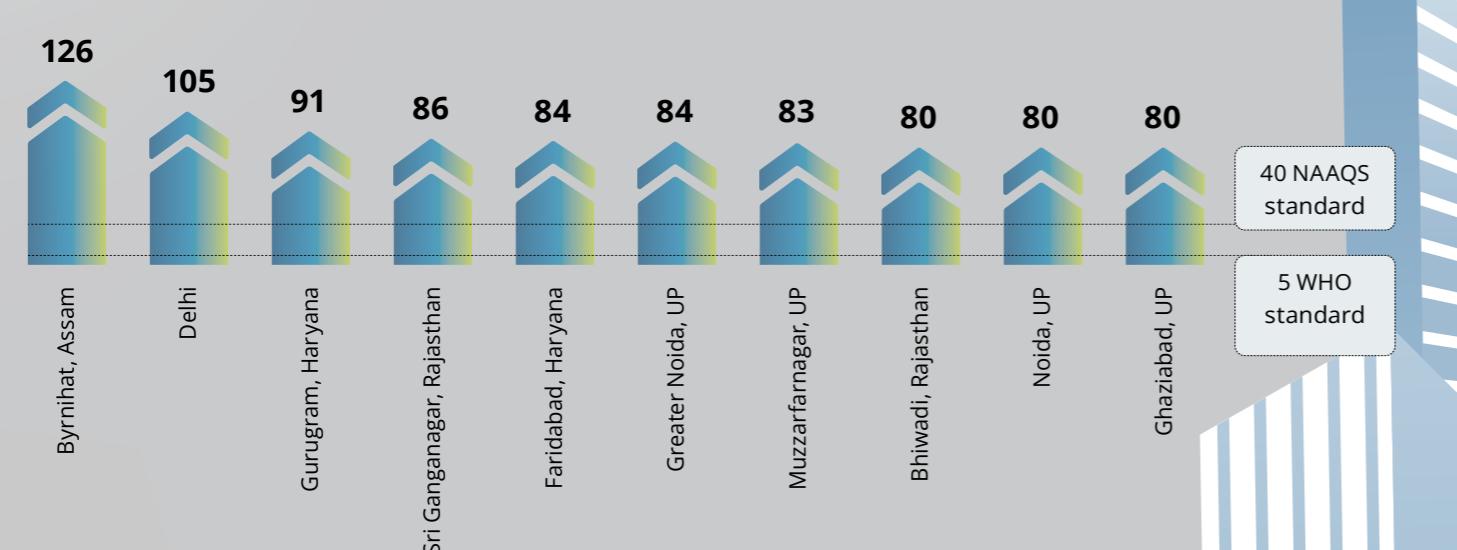
**India leads global pollution charts: 23 of the top 25 most polluted cities in 2024 were in India**  
..with India ranking among the bottom three globally in terms of Air Quality Index

Average Annual AQI in 2024 [in  $\mu\text{g}/\text{m}^3$ ]

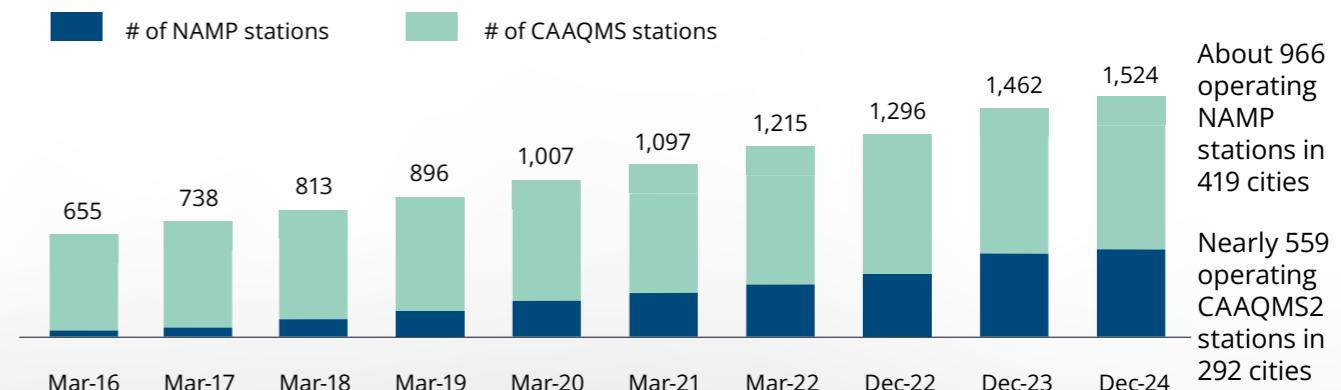


The Indo-Gangetic Plain remains the most affected region, with the highest concentration of cities in the global top 50 - illustrating how geography, urbanisation and industrial activity converge to create a persistent air quality hotspot

#### PM 2.5 Average Annual Concentration- Top 10 Cities, 2024



#### The limited scope of monitoring infrastructure masks the actual magnitude of India's air pollution challenge



India's air-quality monitoring network has grown from 655 stations in 2016 to over 1,500 in 2024, an increase of over 130 percent in eight years. While this represents a major expansion of coverage, about 80 percent of cities are still served by only one station, with five or more stations mainly found in larger metros and Tier-1 cities

Nationally, the total number of stations - spanning both the National Air Monitoring programmes and the Continuous Ambient Air Quality Monitoring System - remains just over 1,500, far below the estimated minimum requirement of 4,000+

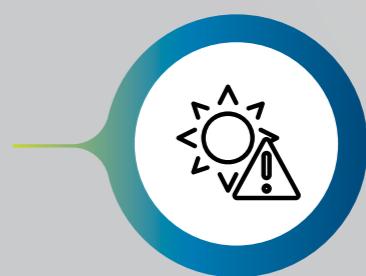
Emerging solutions such as low-cost microsensors could complement existing infrastructure by expanding coverage and enabling more granular, real-time air quality data.

#### Rising pollution levels are straining health systems, economic output and climate stability



##### Climatic disruptions

Pollution affects cloud formation and rainfall patterns



##### Chronic exposure risks

Long-term AQI exposure linked to respiratory illness, lower labour productivity and increased public health burden. In 2021, 2.1 million early deaths linked to air pollution

## Climate indicator 4:

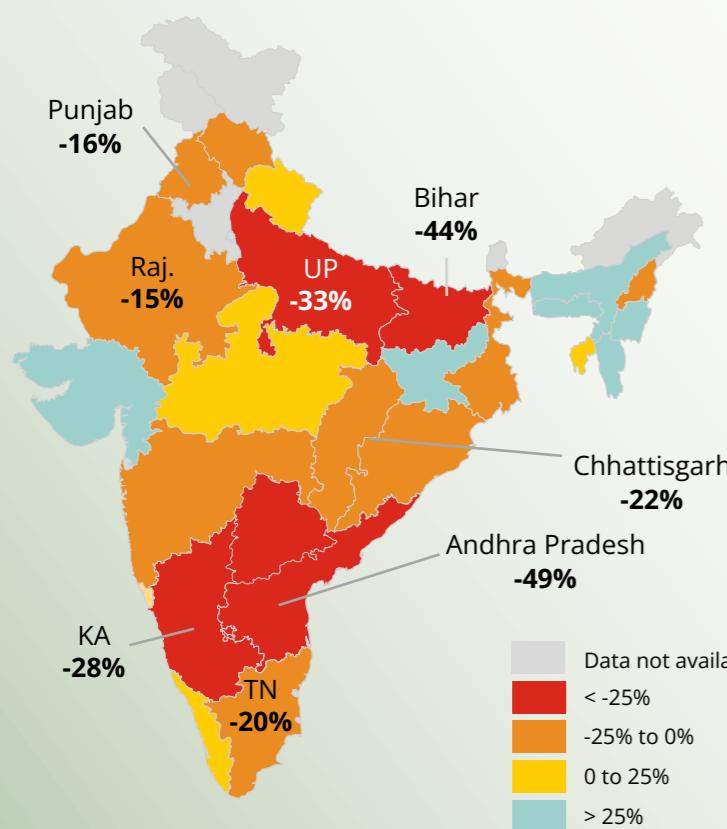
### Rivers

#### India's rivers are increasingly stressed due to extreme weather, diminishing water flows and rising pollution

Additionally, India is witnessing a **troubling pattern of droughts followed quickly by floods** (a sign of intensifying hydrological extremes). In 2016, the Ganga in Bihar ran completely dry by May, only to flood three months later, displacing over 33 lakh people.

Floods are becoming **more frequent and intense**, not necessarily due to more rainfall overall, but due to **short bursts of high-intensity rain over fewer days**.

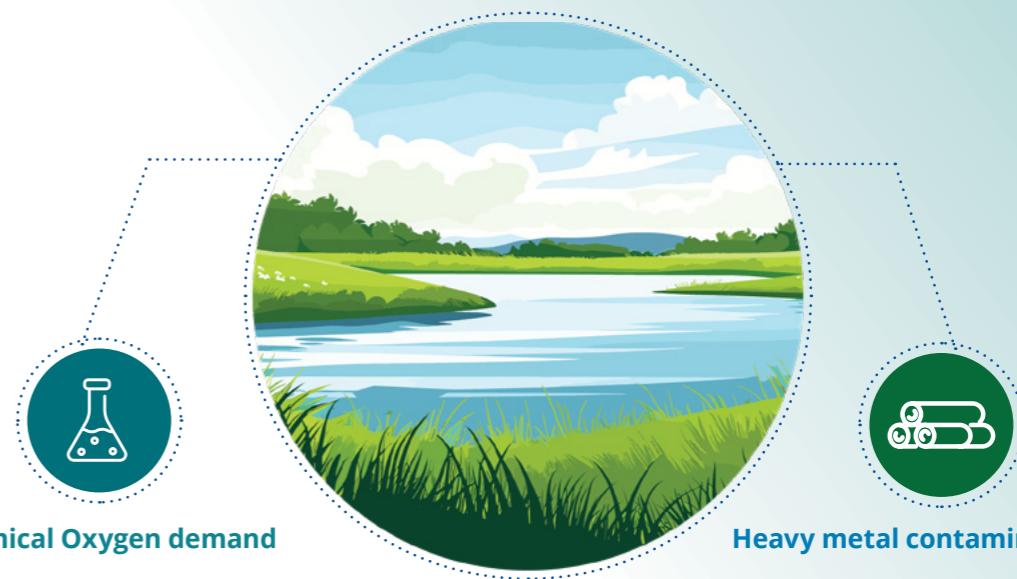
#### Water reservoir levels in 2024 were below the 10-year average in 15 states



#### Capacity across India (% of total capacity)

11%	North India
11%	Eastern India
21%	Western India
27%	Central India
30%	Southern India

With river volumes shrinking, water quality is deteriorating as well; untreated sewage and industrial waste are compounding ecological stress and undermining water security



#### Biochemical Oxygen demand

- About **43 percent of BOD stations** across Indian rivers report levels **above safe thresholds**, indicating widespread organic pollution.
- **Yamuna through Delhi:** BOD rises from **4 mg/L at entry** to **70 mg/L at exit**, due to **22 major drains** discharging **untreated sewage and effluents**.

#### Heavy metal contamination

- **Heavy metals crisis:** About 50 percent of monitoring stations detect harmful levels of **arsenic, cadmium, copper, chromium and iron** (many linked to industrial waste).
- About **81 rivers and tributaries** have at least one toxic metal exceeding safety thresholds.

India treats only 28 percent of the 112,000 MLD sewage it generates; cities are discharging more than they can clean



**Urban sewage** is the main load. **About 65 percent of India's sewage** is generated in cities, much of it dumped untreated into water bodies.



While insufficient capacity still contributes to river pollution and higher flood risk during monsoon seasons, **treatment capacity has improved, rising from 21,589 MLD in 2015-16 to 26,665 MLD in 2020-21**. This growth reflects ongoing efforts to better manage runoff and reduce environmental impacts.

## Climate indicator 5:

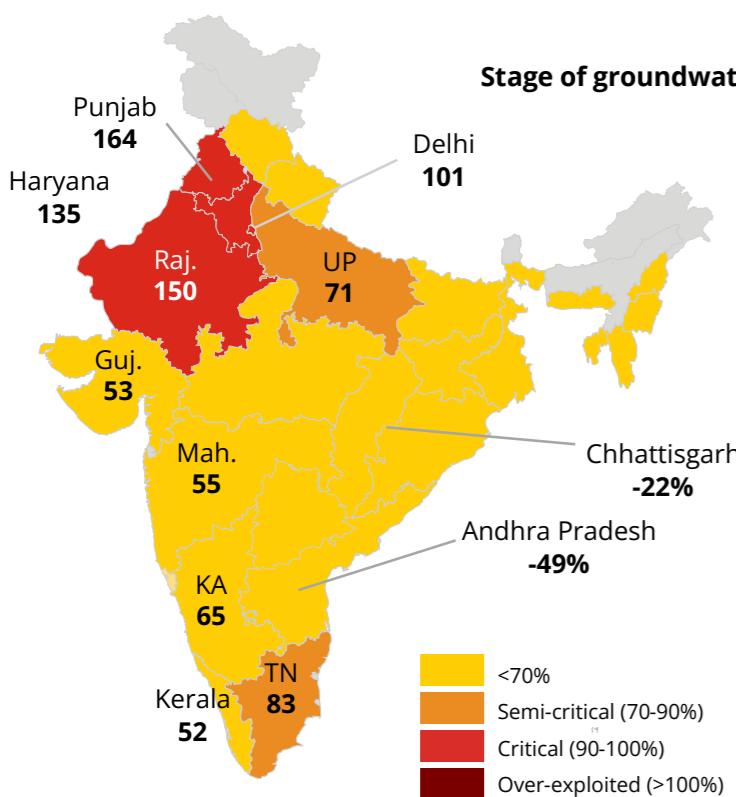
# Groundwater

India's groundwater systems are under severe pressure from overextraction and rising contamination, affecting agriculture, urban water supply and public health

About **87%** percent of India's groundwater is used for agricultural purposes..

.. Feeding a growing population will demand more crop per drop..

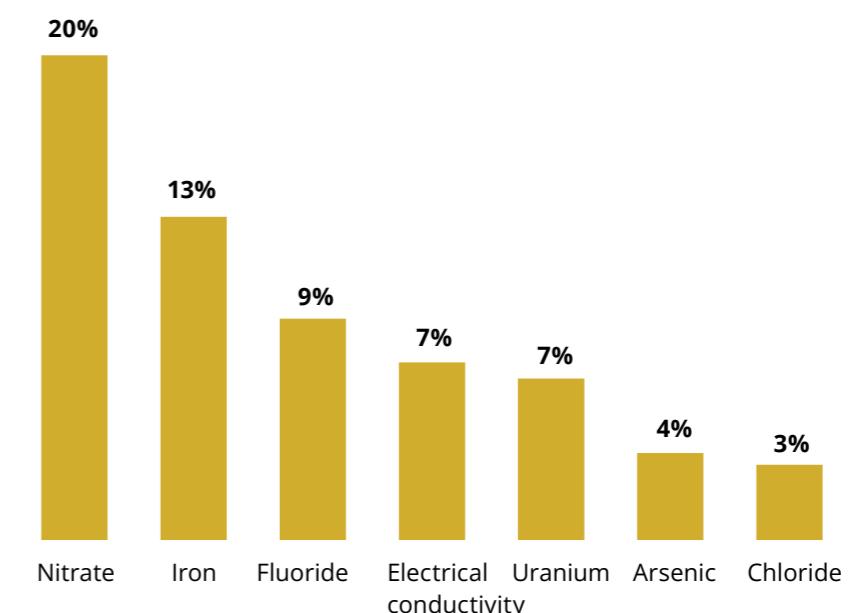
India's groundwater crisis is worsening due to excessive extraction and insufficient recharge, leading to faster depletion of reserves in major cities than they can naturally replenish.



City	Extraction-to-Recharge (%)
Jaipur	223
Gurgaon	212
Bengaluru	187
Amritsar	177
Chennai	125
Indore	119
Agra	117
Hyderabad	103
Gandhinagar	103
Amravati (Maharashtra)	79
Puri	54
Mumbai	46

Groundwater quality is deteriorating due to rising levels of contamination driven by excessive fertiliser use, industrial discharge and inadequate sanitation.

% of groundwater samples beyond permissible limit per Bureau of Indian Standards drinking water specification



About 20 percent of samples exceed nitrate limits (2024), trend stable since 2017

Key contaminants: Arsenic, fluoride, nitrate, iron

Nearly 66M exposed to fluorosis; 108M to nitrate-contaminated water

Soil degradation, crop loss and public health risks are mounting

Groundwater monitoring capacity remains limited and is reliant on fragmented data sources; However assessment units have increased over the past two decades



## Climate indicator 6:

### Glaciers

Glacial retreat in the Himalayas is disrupting river flow, increasing flood risk and threatening long-term water security

Glaciers and snowmelt feed some of India's major rivers, sustaining millions across the subcontinent.

River basin	% contribution from glacier and snow melt	Population dependent
Indus*	~40-60 percent	~233-270 million
Brahmaputra	~15-20 percent	~70-80 million
Ganga	~10-20 percent	~600 million

# Sutlej, Beas, Ravi, Jhelum and Chenab

The Hindu Kush Himalayas experienced a **65 percent faster loss of glacier mass** in the 20<sup>th</sup> century, resulting in a loss of **more than 40 percent of ice mass**.

Snow cover is **vanishing earlier each year**, disturbing the timing and volume of downstream water flows.



2024 saw the **lowest snow persistence in 20+ years** across three major basins.



Ganga and Brahmaputra basins were ~17 percent and **~15 percent below long-term snow cover averages**



The decreasing duration of snow cover is affecting seasonal water patterns, which is essential for agriculture, drinking water supply and industrial activity

Glacial lakes are expanding fast: **More glaciers are melting into unstable lakes**, creating new and growing hazards such as **Glacial Lake Outburst Floods (GLOFs)**

# 10.8%

increase in area of glacial lakes and water bodies across Himalayan Region from 2011 to 2024 due to climate change – signaling heightened risk of GLOFs

"The ice-melt from the glaciers is forming glacial lakes across the Himalayan range. The number of such lakes in **Uttarakhand and east of Himachal Pradesh** has increased from 127 in 2005 to 365 in 2015."

Extreme events are surging in the Himalayan region

**A disaster-prone region due to geography:**

About 44 percent of India's disasters (2013-2022) occurred in the Himalayas, which cover just 18 percent of land.

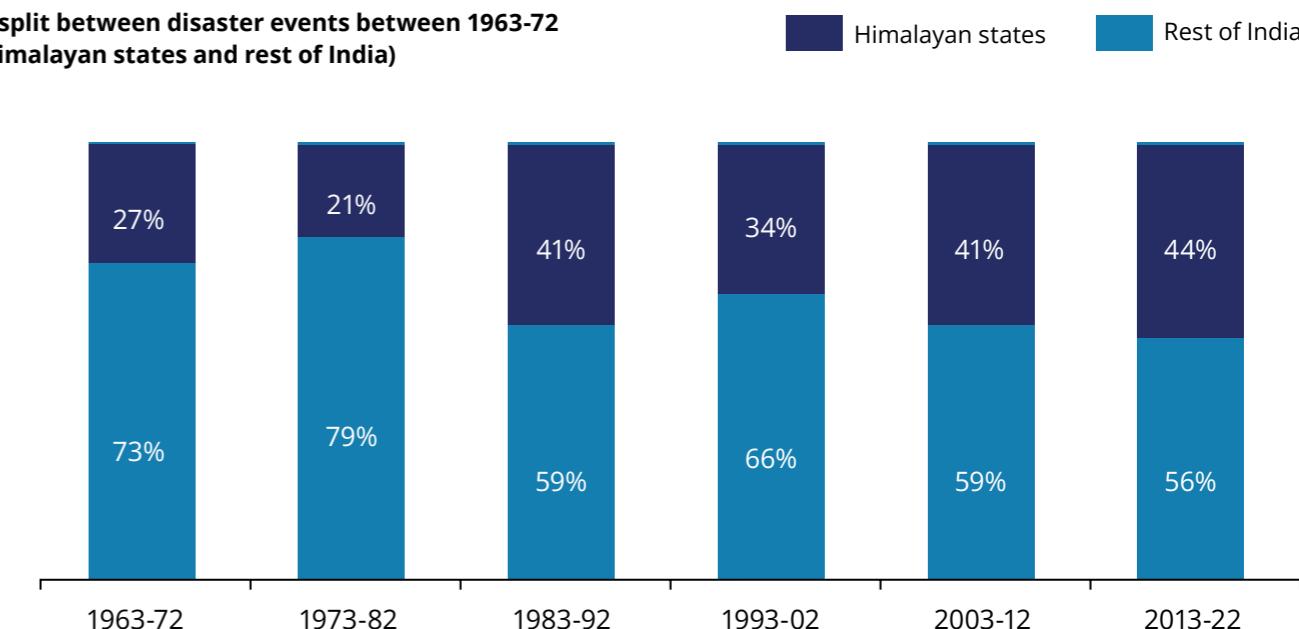
**Fragile terrain:**

Young mountains prone to landslides, erosion and quakes.

**Climate stress rising:**

Flash floods, GLOFs and landslides are becoming more frequent.

**% split between disaster events between 1963-72 (Himalayan states and rest of India)**



**Data blind spots undermine risk assessment**



**Gaps in field data**

India lacks weather stations above 4,000 metres - where most glaciers originate.



**Satellite dependency**

Most recent insights stem from satellite imagery, with sparse ground-truth validation.



**Fragmented research landscape**

While India has initiatives such as the National Mission for Himalayan Ecosystem (DST, 2022) and NDMA GLOF Guidelines (2020), it still lacks a dedicated agency for cryosphere research, despite being home to one of the world's largest glacier systems.

## Climate indicator 7:

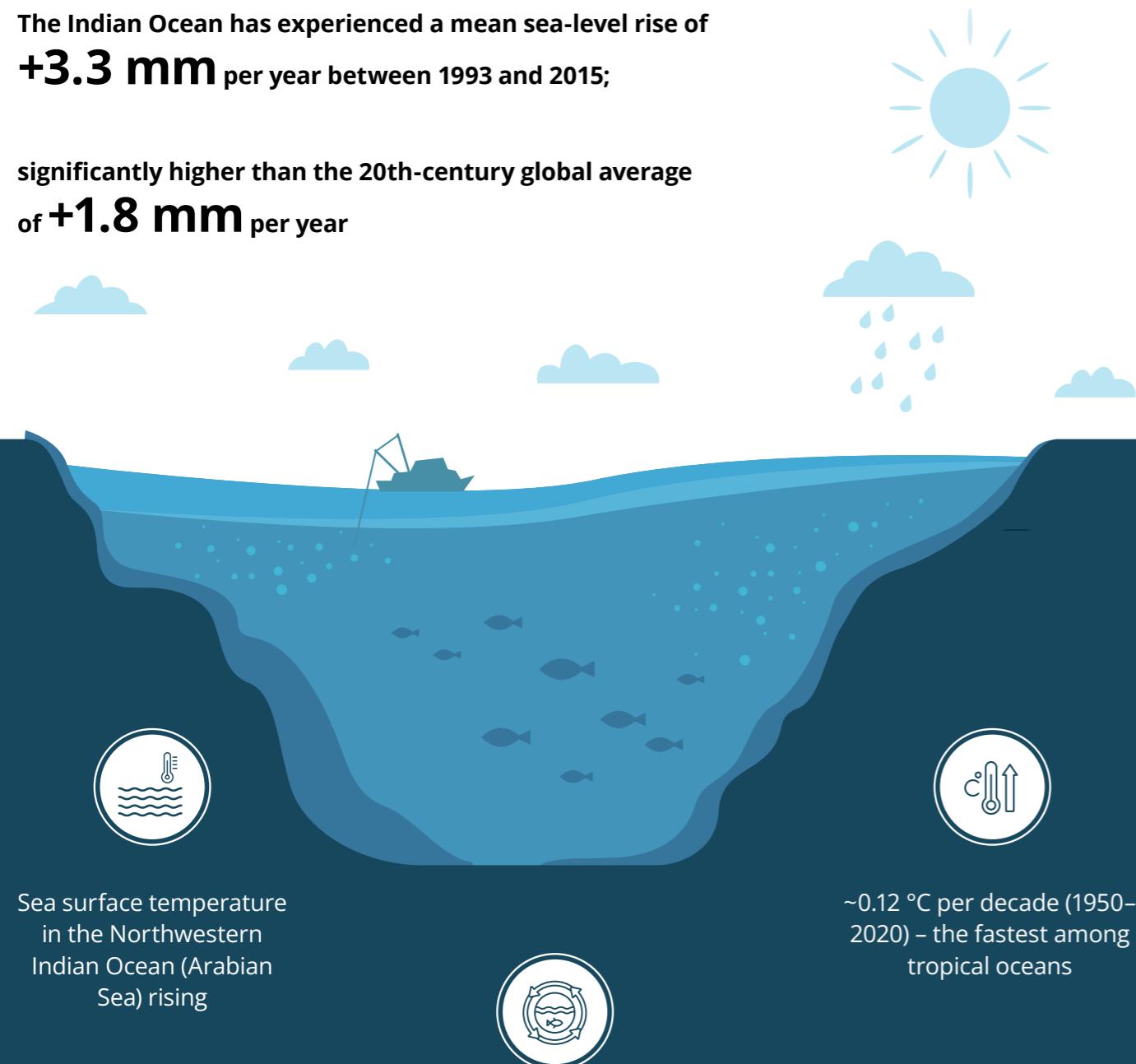
### Ocean ecosystems and marine biodiversity

The Indian Ocean is warming more rapidly than any other tropical ocean or sea, significantly impacting marine ecosystems

Indian Ocean warmed **+1.2°C** since 1950; projected **+3.8°C** by 2100

The Indian Ocean has experienced a mean sea-level rise of **+3.3 mm** per year between 1993 and 2015;

significantly higher than the 20th-century global average of **+1.8 mm** per year



Oceans are losing oxygen and pH: Deoxygenation and acidification are triggering ecosystem collapse, especially for coral reefs

- Western Indian Ocean phytoplankton down **~20 percent** since the 1950s
- Coral reefs are threatened as ocean pH is projected to fall from **8.1 to 7.7** by 2100



Coastal communities are at risk: Sea-level rise and stronger cyclones are pushing millions in India's coastal belt into climate risk

- Arabian Sea cyclones up **52 percent** (2001-19); very severe ones up **150 percent**
- Cyclone Amphan (2020) caused inland flooding up to 25 km
- Livelihoods of coastal fisherfolk under threat from fish stock shifts

#### Climate response remains fragmented

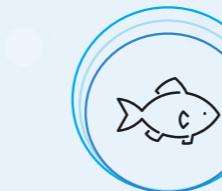
While climate response efforts exist – Implementation gaps exist and require more funding



Need to deploy more real-time ocean monitoring systems to gather data on temperature changes, salinity levels and ocean currents.



MoES has proposed 'National Coastal Mission' to be included within the NAPCC, which will address climate-change threats to coastal zones, mangroves, corals and seawater intrusion into freshwater systems. However, to be comprehensive, this mission must also cover deep-sea systems, pelagic ecosystems and the entire ocean ecosystem.



Enhanced international cooperation and investment in oceanographic research and infrastructure are necessary to better understand and mitigate the impacts of ocean warming.

2021 report by the Intergovernmental Panel on Climate Change (IPCC) indicated that the Indian Ocean has warmed faster than any other ocean since the 1950s. Down to Earth, Ministry of Earth Sciences, India Today, The Guardian, National Library of Medicine, World Bank, Indian National Centre for Ocean 56,57,58,59,60,61,62,63

## Climate indicator 8:

# Forests and biodiversity

India's forest ecosystems are under mounting pressure, with fires, habitat loss and biodiversity decline escalating across the country

Forest loss is escalating across states as more forest land is being diverted, and fires are rising in vulnerable regions.

~17,382

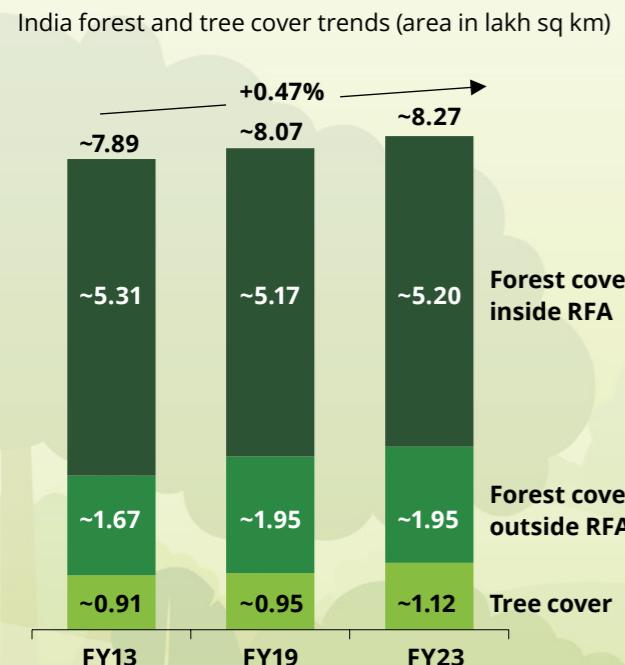
hectares of forest land diverted for non-forest use in 2022-23

~11,097

forest fires recorded in 2024: A 6.7x rise in Himachal, 2.7x in Uttarakhand



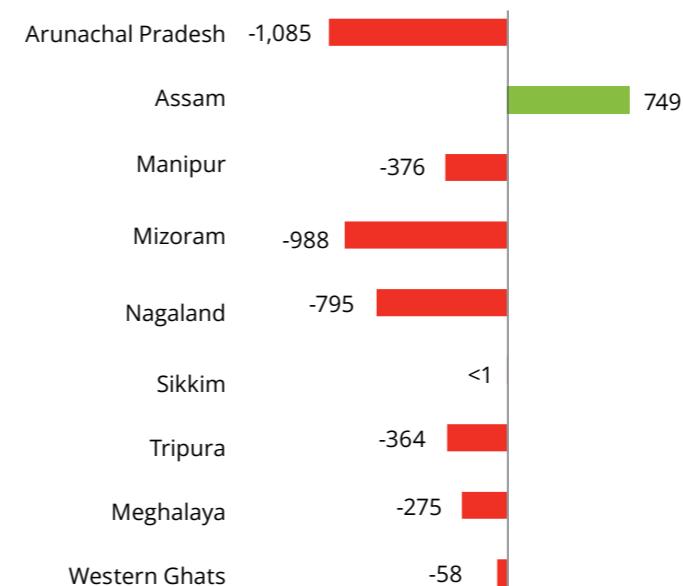
Forest loss is escalating across states: While overall forest cover is rising, core forest areas are declining



- Total forest and tree cover has increased by ~4.8% over the past decade
- Decline in forest cover inside Recorded At an absolute level, Total forest and tree cover has increased by ~4.8 percent over the past decade
- About 55 percent of the national forest/ tree cover increase is from **outside** RFAs
- Andhra Pradesh, Kerala, Karnataka, TN and Odisha saw ~14,800 km<sup>2</sup> net rise, but **84 percent of that** is outside RFA boundaries

## Biodiversity hotspots are being eroded: Forest loss is concentrated in ecologically rich areas such as the Western Ghats and the Northeast

Forest cover losses (km<sup>2</sup>) during 2013-2023



- Western Ghats and the Northeast **lost over 3,190 km<sup>2</sup>** of forest cover over the last decade
- Tamil Nadu lost ~284 km<sup>2</sup> alone; Goa, Gujarat, Maharashtra and Tamil Nadu lost 381 km<sup>2</sup> collectively
- Only partial recovery in Karnataka and Kerala; net loss remains high in biodiverse zones

Forest degradation is driving species towards extinction; shrinking habitats and food sources are triggering biodiversity collapse

Threatened plant species in India



Threatened animal species in India



Millions of people rely on forests for food, fuel and income; degradation threatens survival

- About 300 million people are dependent on forests
- Forest degradation impacts the collection of fuelwood, bamboo, honey and medicinal plants
- Erosion in forest-based incomes threatens food and livelihood security in rural India

Data gaps undermine forest conservation: Fragmented forest data makes it difficult to take effective action



Cloud cover, terrain complexity and **mixed vegetation** confuse satellite readings



Inconsistent legal definitions and ground verification methods across states

## Societal indicator 1:

### Agriculture and food systems

#### Agriculture at the core: A backbone under pressure

~18.2 percent of GDP

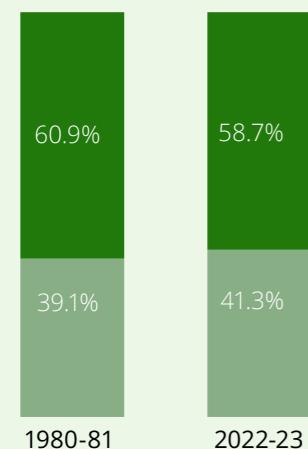
~89 percent are small/marginal farmers

~47 percent of the workforce

~55 percent of net sown area is rainfed

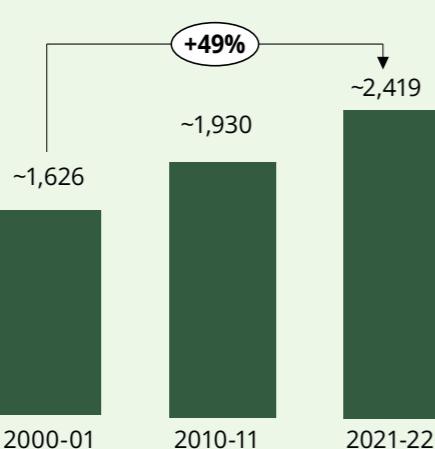
#### Agricultural land is constantly strained by shrinking cultivation areas and the push for higher yields, partly achieved through increased fertiliser usage

Share of agricultural land has been declining over the past decades



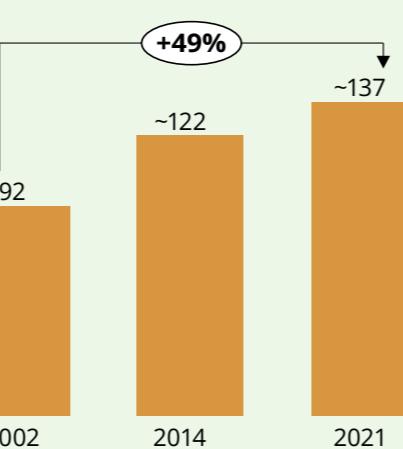
At the same time, agricultural productivity has been on a rise

Yield (Kg/Hectare)



While fertiliser usage has risen, efficiency has dropped

Fertiliser consumption (Kg/Hectare)



Fertiliser efficiency has gone down from **13.4 kg grain/kg NPK<sup>2</sup>** in 1970 to **3.7 kg grain/kg NPK** in 2005

#### System under strain: Weather shocks and yield gaps

India's food security is largely dependent on irrigated regions.

Rainfed ~2-3 t/ha

Irrigated ~5t/ha

- Cropland exposure to floods, droughts and heatwaves
- **70 million ha of cropland** affected by climate events (2015–2021)

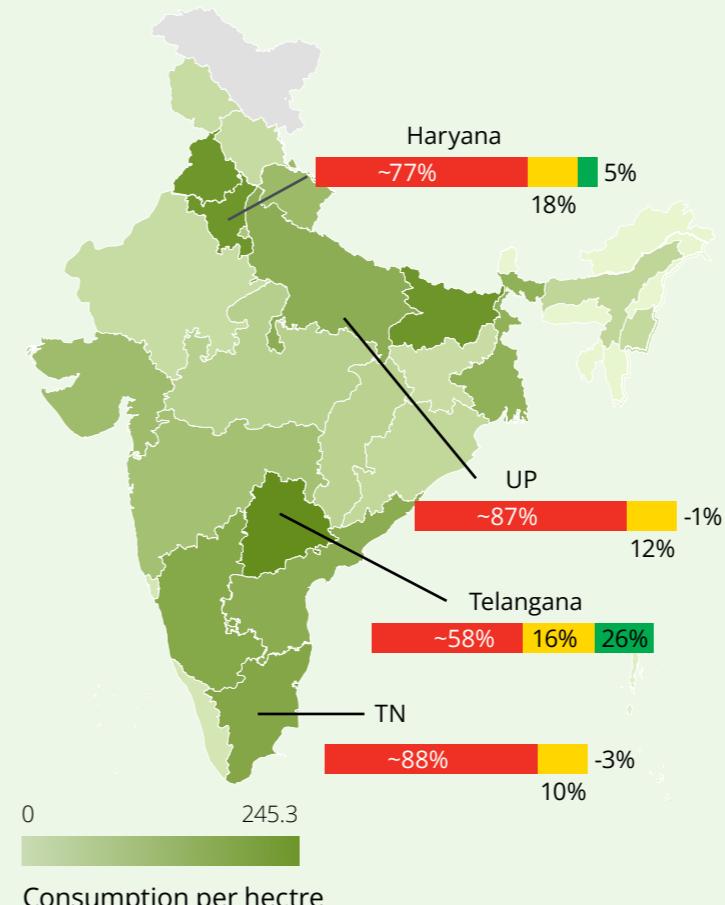
#### Unsustainable agricultural practices, including increasing fertiliser use and the rise of monocropping with water-intensive crops, have severely degraded soil quality

Striking soil quality degradation, especially in states with higher-than-average fertiliser usage

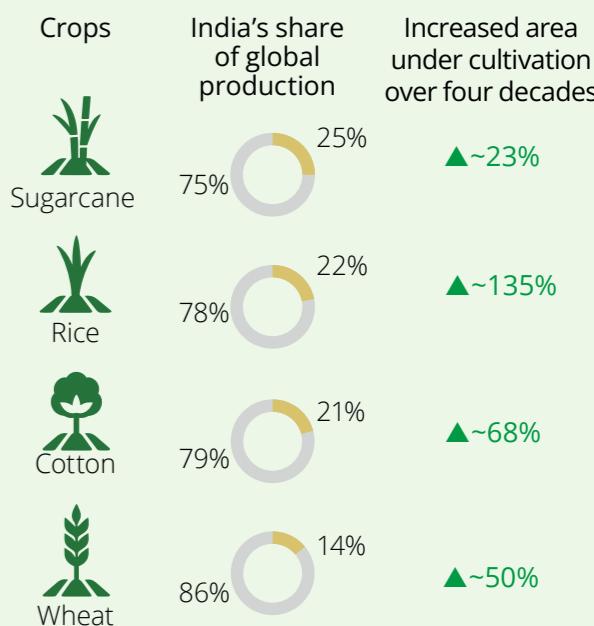
##### Organic Carbon Levels – India 2023-24



##### State wise consumption of fertiliser per hectare



Area under cultivation for water intensive crops has been growing over the past decades, with India emerging as a major producer globally



In Punjab, rice and cotton account for **about 94 percent of the Kharif season crops**, while wheat dominates **about 98 percent of the Rabi season**. In Haryana, **rice and cotton make up about 68 percent of the Kharif season**, while **wheat accounts for about 76 percent of the Rabi season**.

"Wheat yields are projected to decrease by 19 percent by 2050 and up to 40 percent by 2080 in India alone; rice yields are expected to decline by 20 percent by mid-century in many regions, including India, in the absence of any adaptation measures"

## Societal indicator 2:

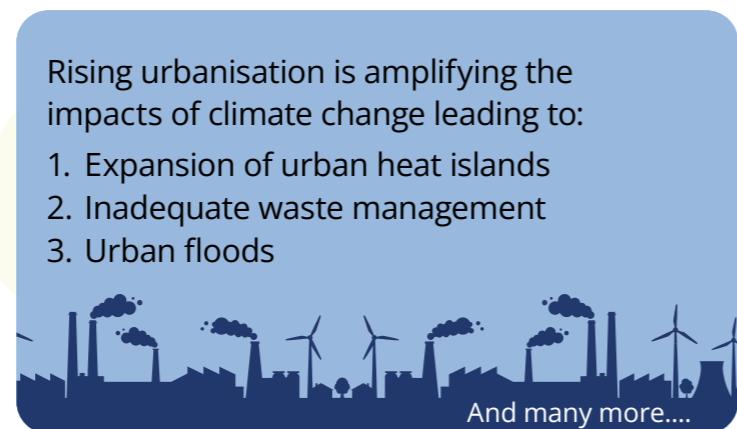
### Urban and industrial activity

#### Cities at a crossroads: The rising urban climate crisis

India's rapidly growing cities are intensifying climate risks, threatening ecosystems, infrastructure and human health

About  
**2.5**  
million Ha  
*increase in India's built-up area over the past 17 years, from 2005-06 to 2022-23*

About  
**40**  
percent  
*of the Indian population lived in cities as of 2023, projected to grow to 60 percent by 2050*



#### Expansion of built-up areas, rise in high-rises, higher vehicular density, and increased air conditioning contribute to the UHI effect



##### Land use change

**Built-up areas have expanded significantly** as a proportion of total urban land over the past two decades, reflecting intensifying urbanisation



##### Urban morphology and materials

Dense urban canyons trap heat as street geometry and clusters of high-rise buildings reduce wind flow and limit night-time cooling.



##### Rising HVAC consumption

Currently, only **~8 percent of households have room air conditioners, projected to surge to ~40 percent by 2037-38.**



##### Vehicular emissions

Vehicular emissions contribute ~20-30 percent to air pollution in Indian cities, primarily affecting PM2.5 level

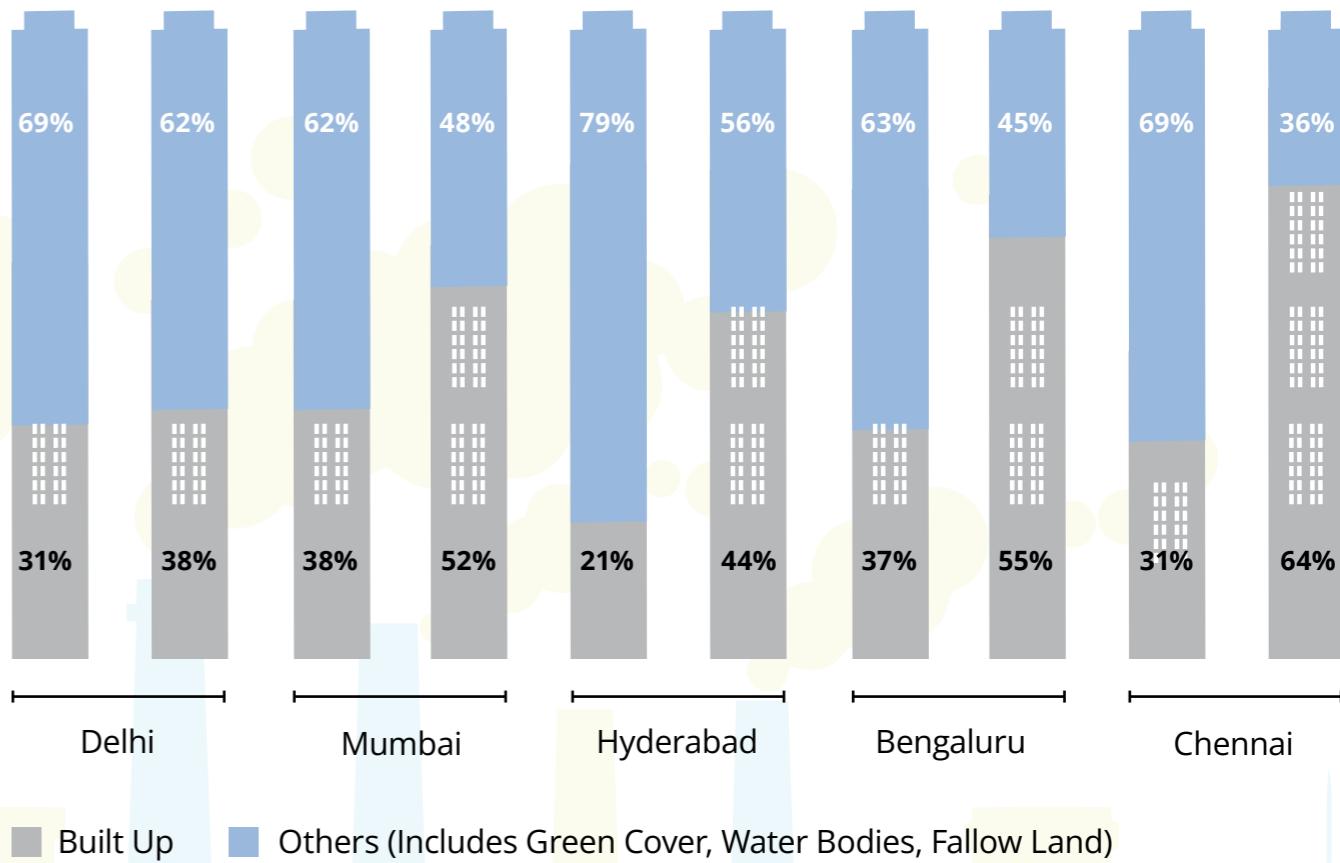
The number of automobiles has increased from 128 million in 2010 to 355 million in 2022

Four Indian cities feature in the top 20 most congested cities in the world

##### Urban green and blue spaces

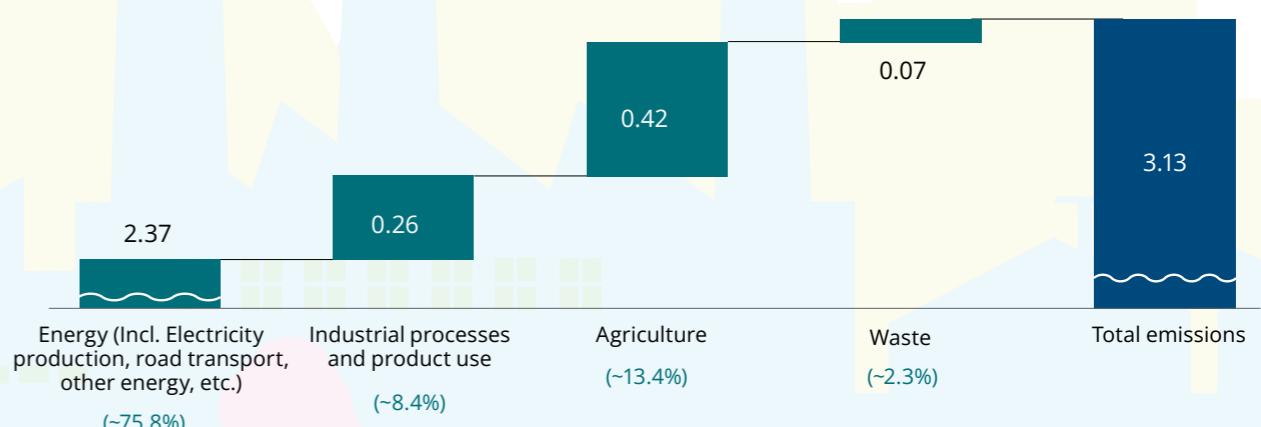
have steadily declined, giving way to increased concretisation and reduced ecological resilience

The built-up area as a % of total land areas in cities has been on the rise over the past two decades



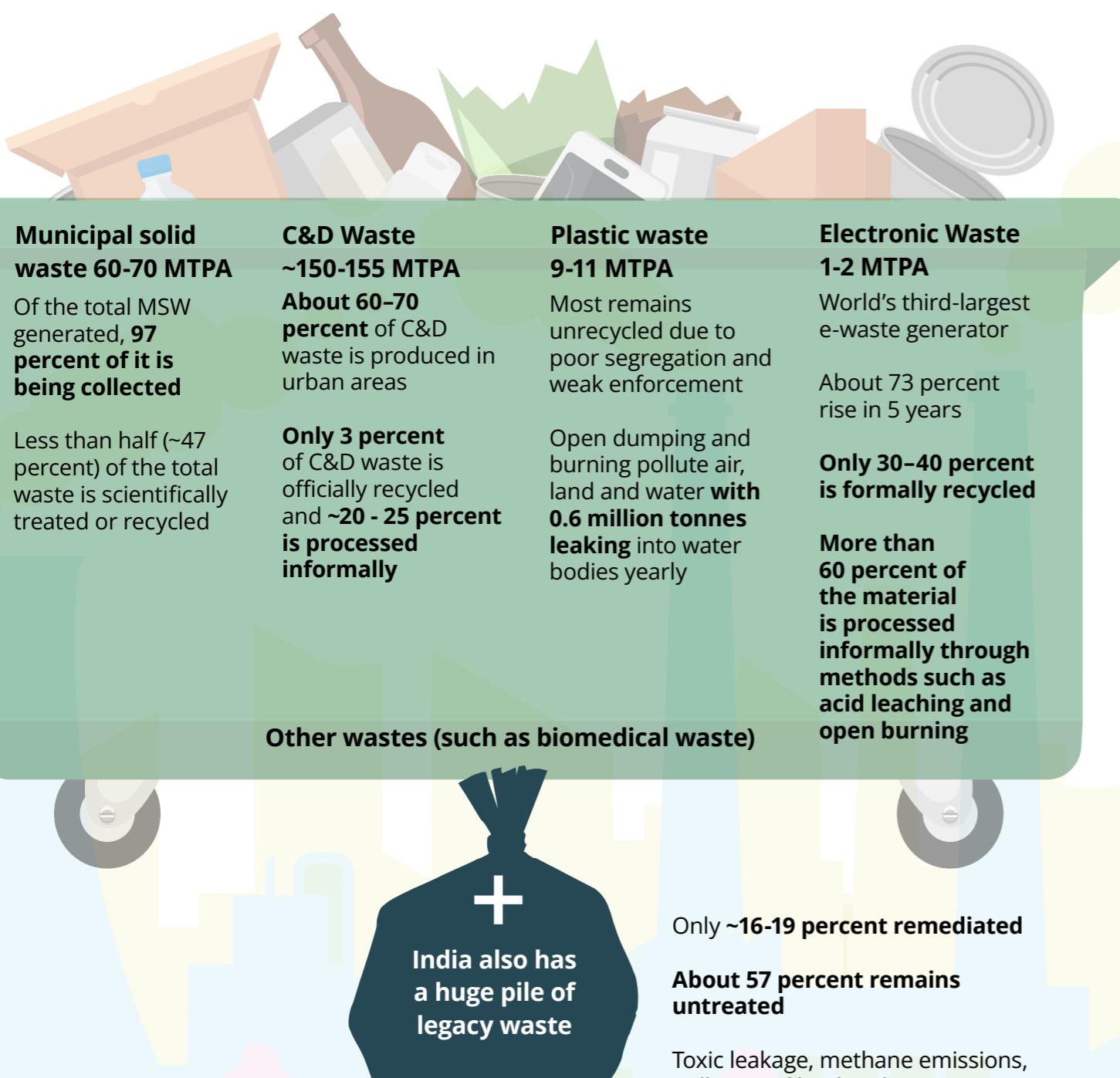
#### Detailed Greenhouse Gas Emissions from India [In Gt CO<sub>2</sub>]

The industrial sector, contributing ~31 percent to India's GDP and employing over 120 million people, is a key part of the economy, with a current ~8 percent share of national greenhouse gas emissions through industrial processes and product use.



## India's growing waste challenge is shaped by weak segregation practices, unmanaged disposal, limited infrastructure and policy gaps

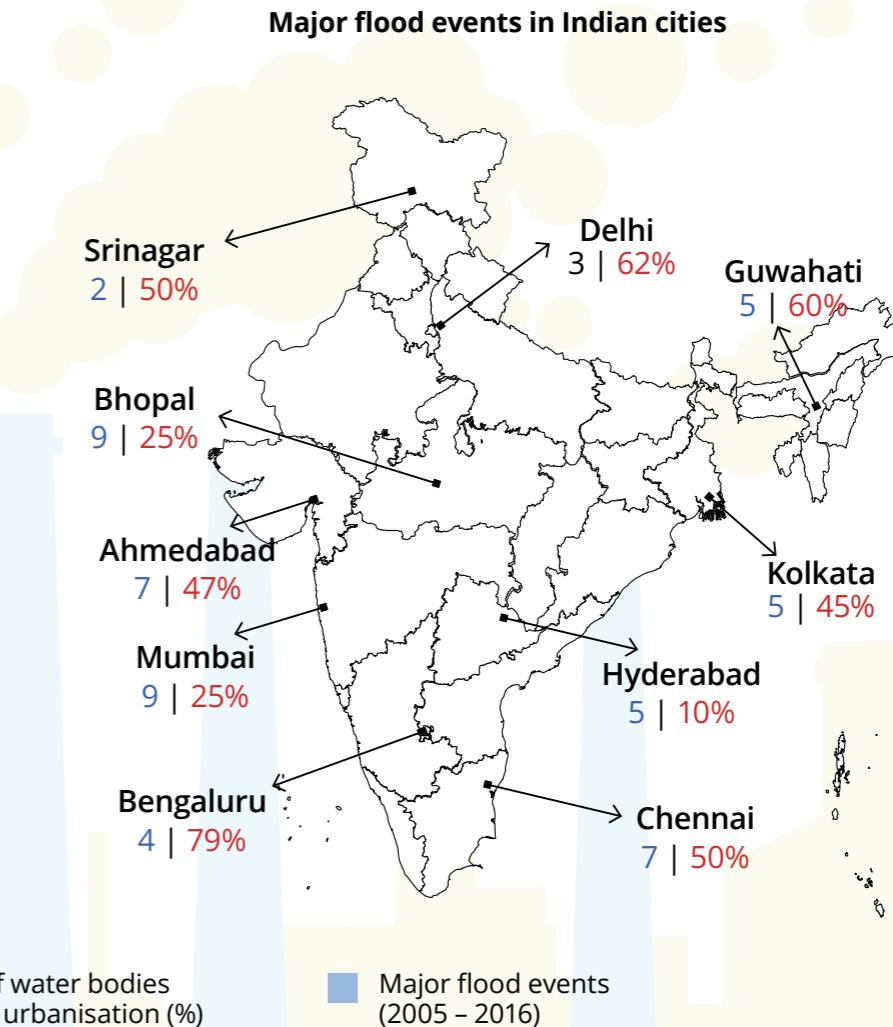
India generates more than **200–250 million** tonnes of waste annually



In addition to Human waste, India generates 7.9 MTPA of Hazardous Industrial waste: Of which, **~3.98 million tonnes (~50.4 percent) is recyclable**, while **~3.32 million tonnes (~42.0 percent) is landfillable** and the remainder (~7.6 percent) is incinerated

**Fewer rainy days, interspersed with intense downpours and extended dry spells, have created a dual threat, escalating urban flooding and prolonged drought conditions**

About 1.8-8x higher flood peaks in cities



The loss of water bodies contributes to increased flooding because these natural areas serve as buffers that absorb excess water during heavy rainfall. Without them, stormwater cannot be effectively stored, resulting in higher runoff and more severe flooding.

Source: Handbook of Urban Statistics, National Institute of Urban Affairs, Green Tree Global Research, Down to Earth Report, CBRE Research, CEIC (MoRTH), India Cooling Action Plan (ICAP), IWA Publishing, Central Groundwater Board, CPCB, Centre for Science and Environment, National Remote Sensing Centre (ISRO), IEA.ORG, 2022, Vahan Dashboard, Ministry of Road Transport & Highways (MoRTH), Government of India <sup>81,82,83,84,85,86,87,88</sup>

# Gaps in India's climate ecosystem

India's climate response has advanced through growing awareness, strong leadership commitments and emerging innovations. Yet, progress remains constrained by systemic gaps, such as technical, financial, structural, behavioural and institutional, that continue to restrict the pace, reach and inclusiveness of progress.

## Key challenges in India's climate landscape and areas to address for stronger action

### 1. Fragmented governance and policy misalignment

- India's climate responsibilities are scattered across multiple agencies, often working in silos.
- There is also a lack of proper implementation and standard benchmarks, which reduces accountability.

Current governance of air quality remains fragmented across multiple agencies, with little emphasis on managing pollution at an airshed level. This hampers effective action, leads to mismatched interventions and weakens accountability

### 2. Data deficiency and poor climate infrastructure

- Fragmented and inconsistent data make integration and comparison difficult
- Use of advanced technologies such as drones or IoT sensors remains low
- Lack of interoperable, real-time monitoring systems undermines both planning and early action
- Absence of a central coordinating institution and underrepresentation of many regions hampers data-driven climate action

Air quality monitoring infrastructure is inadequate, with poor spatial coverage in smaller cities, remote regions and ecologically sensitive zones

- India's rainfall measurement network is also constrained by low spatial resolution, limiting hyper-local analysis critical for agricultural and flood planning.
- Groundwater levels in hilly regions are difficult to assess due to complex terrain and irregular aquifer systems.

### 3. Neglect of systemic and interconnected risks

- Current efforts largely centre on direct emissions and mitigation, with comparatively little focus on cascading or second-order impacts such as heat-related health burdens, migration pressures and interconnected water-energy stress

For example, manufacturers need to embed climate considerations across sourcing, logistics and product lifecycle

### 4. Weak links between research, policy and industry

- Research, government and industry often work in silos, limiting the impact of even high-quality climate innovation.
- Promising pilots struggle to scale due to unclear ownership and weak institutional linkages.
- Researchers must align with market needs, policymakers must enable collaboration and scale, and businesses must use evidence to shape supportive regulation.

Researchers must align with market needs, policymakers must enable collaboration and scale, and businesses must use evidence to shape supportive regulation.

“Sustainability is deeply rooted in India's heritage. At Pidilite, it guides how we grow, innovate, and build - with cleaner energy, responsible products, and meaningful community initiatives. We see sustainability not as a milestone, but as a value, one that quietly shapes every decision we make.

**Sudhanshu Vats**  
Managing Director, Pidilite Industries Limited

## 5. Limited climate talent availability

- There is a shortage of people trained in climate science, data and systems thinking, which are essential skills for designing and implementing effective climate responses.
- The field remains niche, with limited institutional support.

For instance, many urban local bodies lack in-house climate expertise and rely on generalists or short-term consultants, leading to weak and fragmented climate planning.

## 6. Lack of clarity, capacity and standards undermines climate action

- Confusion between ESG, CSR and sustainability leads to fragmented, shallow efforts across institutions.
- Climate equity remains an afterthought, increasing inequality and weakening resilience.
- Limited inclusion of vulnerable communities in planning

Many organisations run isolated CSR activities such as tree planting, while ESG teams focus narrowly on compliance. Without clear climate metrics or equity integration, such efforts remain fragmented and ineffective.

## 7. Gaps in funding and commercial viability

- Access to finance remains challenging, especially for early-stage start-up or solutions in hard-to-abate sectors.
- Climate finance lacks clarity, structure and inclusivity.
- Many innovators, especially in rural and hard-to-abate sectors, remain locked out of mainstream capital.

Start-ups working on biochar, clean cooling, or regenerative agriculture often fail to secure early-stage funding because their impact is long-term and not captured by conventional financial metrics.

## 8. Limited inclusion of vulnerable communities in planning

- India's informal sector, critical to the economy and highly vulnerable to climate impacts, is often left out of climate plans.
- Most climate plans are designed top-down, overlooking those who face the most immediate and severe impacts. These communities face real risks but have little say in policy or funding decisions.

Deloitte's Citizen Climate Survey reveals that climate change disproportionately impacts vulnerable groups such as women, middle-aged individuals and agricultural households.

“It is essential to complement the climate dialogue with an ecosystem-based action plan. By focusing on specific actions within an industry and sub-industry, we can move the needle meaningfully.”

**Ankit Todi,**  
Chief Sustainability Officer, Mahindra Group

Addressing these challenges would require ecosystem-level interventions rather than isolated, project-based efforts.<sup>89</sup>



# The business risk you can't afford to miss

A similar pattern emerges across the corporate sector. Climate risks, including physical threats such as heatwaves and floods, as well as transition-related pressures from policy, markets and stakeholders, are increasingly shaping business strategy and financial decisions. In India, these risks are deeply sector-specific and shaped by operational footprint, resource dependencies and geographic concentration.

As highlighted earlier, findings from the Corporate Climate Readiness Survey show that physical climate impacts such as extreme heat, water stress and

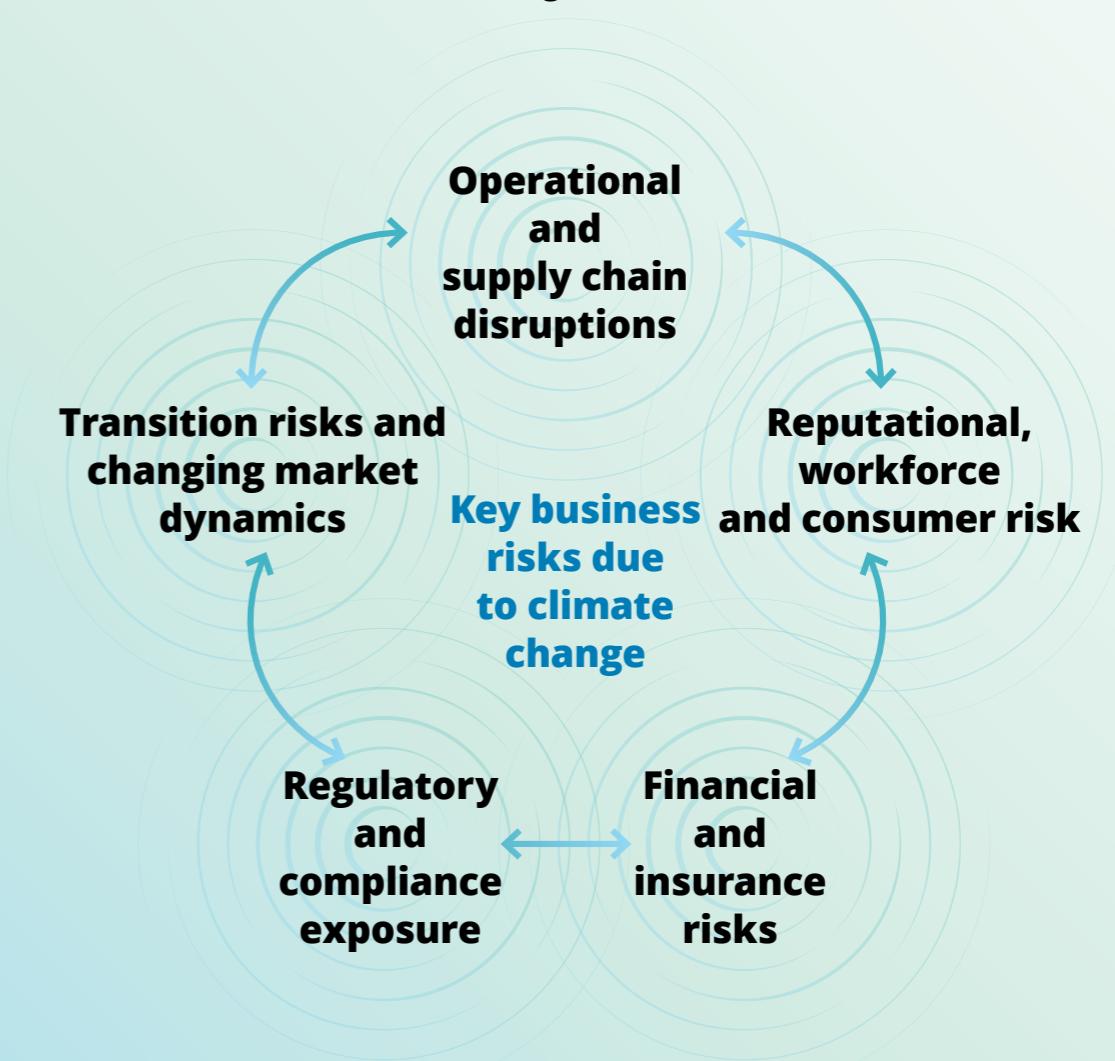
flooding are already among the most critical operational concerns for Indian businesses.

These vulnerabilities directly affect business continuity and resilience, influencing supply chains, asset productivity, workforce health, and consumer behaviour. A large share of surveyed companies report operational disruptions from climate-related events, alongside growing concerns about employee well-being and shifts in consumer preferences, underlining how climate change is no longer an externality but a strategic business issue.

“Our customers value us for our commitment to sustainable practices that not only strengthen trust but also set us apart in the marketplace. Sustainability has become a true differentiator - driving innovation, efficiency and long-term value.”

**Vijay Shah**  
MD & CEO, PGP Glass Pvt Ltd.

## Key business risks due to climate change



These illustrate how these threats cut across operational, financial, regulatory and reputational dimensions — from supply chain disruptions and resource scarcity to compliance pressures and investor scrutiny. Despite the growing risks and awareness, many Indian corporates remain in the early stages of climate preparedness.



**84%**

say climate change already impacts business strategy and operations

# 1 Operational and supply chain disruptions

Extreme weather events such as heatwaves, cyclones, droughts and erratic rainfall are becoming more frequent and severe in India. They are increasingly disrupting India's manufacturing, logistics and supply chain operations

## Key sectors impacted

- Agriculture-linked industries (such as FMCG, food processing, agri-inputs) experience first-order risks from rainfall variability and heat stress. Erratic monsoons caused ~15- 30 percent annual crop losses in the affected regions. The 2023 floods in Himachal Pradesh and Punjab submerged ~200,000 hectares of rice fields, which disrupted both farming activities and downstream supply chains.
- Water-intensive industries such as textiles, food and beverage face growing supply chain risk from drought and groundwater depletion.
- Manufacturing and heavy industry also face downtime and productivity loss due to flooding and extreme heat

## Insights from Deloitte CXO Survey 2024

~78 percent of CxOs in India expect that climate change will affect their companies' strategies and operations to a high/very high extent in the next three years.



# 2 Transition risks and changing market dynamics

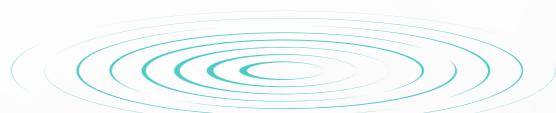
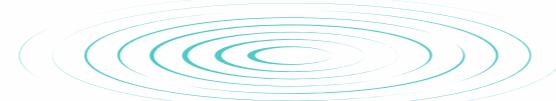
As India targets net-zero emissions by 2070, companies that are not aligned with the low-carbon economy risk becoming obsolete, and businesses face transition risks.

## Key sectors impacted

- Energy sector: Thermal plants face challenges from water stress, while renewables are affected by cyclone damage and decreased efficiency from haze and pollution, hydropower from glacial melt, floods, and shifting rainfall.
- Financial services: Indirect exposure via financed assets. Lending to vulnerable sectors (agriculture, real estate, MSMEs) can raise defaults and erode credit quality. IRDAI reports rising insured losses from natural disasters, straining insurer solvency.

## Insights from Deloitte CXO Survey 2024

Over half of Indian CxOs indicate their organisations are working with local communities to address inequities, mitigate climate vulnerabilities and prepare workers to transition to green jobs.



## 3 Consumer risk

Businesses that neglect climate responsibility risk reputational harm, social-media backlash and loss of consumer trust, especially among younger audiences. Climate-conscious, purpose-driven firms are more attractive to skilled professionals.

### Key sectors impacted

- Hospitality and tourism: Climate variability is reshaping tourist flows. In Himachal Pradesh, hotel occupancy dropped from 29 percent in early July 2024 to just 21 percent in 2025 due to flash floods, cloudbursts and the amplified impact of social media panic.



### Insights from Deloitte CXO Survey 2024

A significant amount of pressure from stakeholders (government, board, peers, consumers, etc.) to increase their climate initiatives (~81 percent).

Over the next five years, the top benefits of climate action are expected to include improved investor returns, enhanced asset values, increased revenue from new businesses, better employee morale and well-being and stronger brand recognition and reputation.

## 4 Regulatory and compliance exposure

Indian businesses face a tightening regulatory regime. SEBI's BRSR is already mandatory for the top 1,000 listed firms, and more sector-specific rules are expected. Future carbon pricing, green product mandates, stricter water norms and other environmental measures could further raise costs and compliance burdens for companies that are slow to act.

### Key sectors impacted

- Large emitting sectors, such as steel, cement, power and oil and gas, face tightening disclosure norms and carbon pricing pressures in the future
- Water discharge and emissions standards in the heavy industry and textiles sector



### Insights from Deloitte CXO Survey 2024

~41 percent of Indian CxOs are transforming their business model to accommodate climate change, but only ~6 percent of their efforts are focused on ensuring compliance with regulatory requirements.

# 5 Workforce productivity risk

Studies show that outdoor workers in India lose over 20 percent of effective working hours during extreme heat days. The Indian Meteorological Department recorded 280+ heatwave days in 2022 alone across major industrial belts, which forced factory shutdowns due to health and productivity concerns. On very hot days, heat waves reduce the supply of physical labour by a quarter, impacting income growth, price stability and investment.

## Key sectors impacted

- Impact of rising temperatures and air pollution on health, safety and productivity across labour-intensive sectors such as infrastructure, logistics and construction
- Construction materials and methods designed for stable climates are proving insufficient in the face of 50°C+ heat days or 300 mm rainfall within hours, leading to a rising demand for energy-efficient buildings and climate-resilient design



### Insights from Deloitte CXO Survey 2024

More than half of the CXOs surveyed indicated use of more sustainable materials, implementing technology solutions and reconfiguring operations as part of their sustainability efforts.

## The intersection of climate risk and sectoral risk has thus become a concern for businesses.

Leading firms are assessing their direct exposures and actively engaging with suppliers to build resilience and future-proof their value chains.

Given the interconnected nature of these risks, businesses must shift from reactive to proactive system-oriented strategies that protect enterprise value and enhance societal resilience through collaboration with governments, industry peers, communities and other stakeholders.

“We prefer to work with suppliers who demonstrate strong sustainability practices. For those not yet aligned, we proactively invest in building their capabilities, through targeted training, technical support and funding to help them meet climate-aligned standards.”

**Uma De Bose**  
Head, Government Affairs, Bosch India

Businesses need to approach climate action through a broader systems lens. This means balancing efforts to cut emissions with strategies that strengthen resilience to the impacts already unfolding around us. While mitigation helps address the causes of climate change, adaptation strengthens our ability to cope with its unavoidable impacts.

In the Indian context, adaptation is especially critical to safeguard lives,

infrastructure and economic stability. As climate risks intensify, prioritising and investing in them becomes not just prudent risk management but also a smart economic decision. A WRI study finds that every dollar a company invests in implementing adaptation and resilience measures can yield over US\$10 in financial benefits.<sup>90</sup> Recognising the urgency of climate risks/challenges is only the first step; businesses need a structured approach that links integrated climate responses directly to business strategy and impact.



## India's current climate response

Despite ongoing climate challenges, a surge of action provides cautious optimism, with initiatives ranging from **government-led policy and infrastructure interventions to corporate climate innovation to community-led adaptation.**

**Central and state-level agencies are shaping policies to address climate risks, strengthen preparedness and promote sustainable development.**

This includes updating regulatory frameworks, expanding early warning infrastructure, strengthening data and monitoring systems and mainstreaming adaptation into core development sectors.

Climate-forward companies are moving beyond disclosure and compliance to embed climate considerations across operations, from sustainable sourcing to green product innovation.

“On climate action, corporations must actively position themselves as collaborators to the government, moving beyond compliance to co-creation. The message is simple yet powerful that we are ready to collaborate, let us identify and unlock opportunities together.”

**Deeksha Vats**  
**Group Chief Sustainability Officer, Aditya Birla Group**

Civil society groups are driving grassroots programmes by mobilising communities and piloting scalable climate solutions. From building climate-resilient livelihoods to restoring local ecosystems, these groups help enable decentralised, people-first adaptation. They are also

bridging the last-mile gap by translating national missions into local action, especially in underserved geographies.

Together, these actors are laying the foundation for a more climate-resilient future.

# Government action

The central government has introduced a wide range of policies and missions to address climate risks. At the national level, India has developed comprehensive frameworks, such as the National Action Plan on Climate Change (NAPCC) and its eight associated missions, alongside thematic policies on renewable energy, energy efficiency and disaster resilience. Many states have developed State Action Plans on Climate Change (SAPCCs), incorporating state-specific priorities.

India's long-term climate and energy vision is anchored in its pursuit of **sustainable growth**, balancing the dual challenges of **climate change** and **energy security**.

The commitment to reach net-zero emissions by 2070 is central to this vision, emphasizing a gradual shift from fossil fuels to renewable energy sources. This transition is about energy production, energy efficiency, infrastructure development and technological innovation. Alongside renewable energy expansion, major investments in modern road and public-transport infrastructure, such as metro networks, regional rapid transit

systems and improved highways, are being made to enhance mobility, reduce congestion and support a more climate-aligned growth pathway. In addition, sector-specific regulations, such as Construction and Demolition Waste Management Rules, Extended Producer Responsibility (EPR) rules for plastics, e-waste and batteries, outline frameworks for post-consumer waste management involving producers. Indicator-level policies on emissions, energy efficiency and pollution control are also in place. Implementation, however, varies across sectors, with differing clarity levels, accountability and institutional capacity.

“India needs regulatory frameworks that are transparent, streamlined and industry supportive. Regulatory bodies must be viewed as strategic enablers, fostering an inclusive and collaborative environment for sustainable growth.”

**Uma De Bose,  
Head Government Affairs, Bosch India**

Building on existing frameworks, four critical opportunities for policymaking to set direction and mobilise industry and capital are emerging: future fuels, critical minerals, batteries and storage, and industrial decarbonisation<sup>91</sup>. Each of these areas represents a strategic lever for reducing emissions and scaling low-carbon solutions across sectors. Progress in these domains would help address the direct sources of emissions and strengthen the broader industrial and energy ecosystem, enabling meaningful decarbonisation by 2030 and beyond.

The table below outlines illustrative key government responses across major climate indicators, summarising the key policies and achievements:



## 1. Climate indicator: Heat

### Key policies

- State/City Heat Action Plans (HAPs) under NDMA guidance
- National Disaster Management (Heatwave) Guidelines, 2016

### Key achievements

- About 23 heat-vulnerable states/UTs are implementing city/regional HAPs, or are implementing HAPs<sup>92</sup>
- IMD issues five-day colour-coded alerts and seasonal heat outlooks<sup>93,94</sup>



## 2. Climate indicator: Rainfall patterns

### Key policies

- Doppler Radar Modernisation Plan (MoES/IMD)
- National Water Mission (MoWR/Jal Shakti)
- “Catch the Rain” (Jal Shakti Abhiyan)

### Key achievements

- Doppler radars expanded from 15 (2013) to 37 in 2023<sup>95</sup>
- Increase in the number of Automatic Rain Gauges (ARG) from 1350 in 2014 to 1382 in 2023<sup>96</sup>
- Since 2021, IMD has started an online interface to collect weather data and the associated impact for six weather events initially (rain, hail, dust storm, wind speed, thunderstorm/lightning and fog)<sup>97</sup>
- Jal Shakti Abhiyan’s “Catch the Rain” campaign and 2022 Amrit Sarovar scheme are boosting rainwater harvesting and recharge<sup>98</sup>



## 3. Climate indicator: Air quality

### Key policies

- NCAP, 2019
- Air (Prevention and Control of Pollution) Act, 1981

### Key achievements

- About 97 of 130 NCAP cities improved PM<sub>10</sub> (2023–24 versus 2017), 55 cities achieved >20 percent PM<sub>10</sub> reduction<sup>99</sup>
- INR13,000+ crore disbursed across 130 cities.<sup>100</sup>



#### 4. Climate indicator: Rivers

##### Key policies

- National Mission for Clean Ganga (NMCG)
- Water (P&CP) Act, 1974
- Environmental flow norms (2018)

##### Key achievements

- About 3,446 MLD sewage capacity added under Namami Gange (June 2025, surpassing the pre-2014 capacity by over 30 times)<sup>101</sup>
- Ganga water quality improved in key stretches (e.g., from Class III to V in UP), 60 polluting drains tapped in Prayagraj<sup>102</sup>
- Namami Gange declared a UN “World Restoration Flagship” (2022)<sup>103</sup>



#### 7. Climate indicator: Oceans and seas

##### Key policies

- Coastal Regulation Zone (CRZ) Notification, 2019
- Deep Ocean Mission (MoPSW, 2021)
- ICZM / MISHTI coastal programmes

##### Key achievements

- Zero casualties due to Cyclone Biparjoy, which hit the Gujarat coast in 2023, and Cyclone Dana, which hit the Odisha coast in 2024, due to monitoring and forecasting<sup>106</sup>
- Mangrove cover expanded by ~ 16.7 km<sup>2</sup> (2019-23)<sup>107</sup>
- ICZM Project developed institutional capacities, advanced structural reforms and supported the creation of scientific data sets to improve the enabling environment for coastal zone management initiatives<sup>108</sup>



#### 5. Climate indicator: Groundwater

##### Key policies

- Atal Bhujal (Water) Yojana (2020)
- Master Plan for Artificial Recharge (MoJS)
- State Groundwater Acts (select states)

##### Key achievements

- About 61.1 percent of CGWB-monitored wells showed rising water levels (Nov 2022 versus Decadal mean of 2012-21)<sup>104</sup>



#### 8. Climate indicator: Forests and biodiversity

##### Key policies

- National Forest Policy, 1988
- Forest (Conservation) Act, 1980
- Wildlife Protection Act, 1972
- Project Tiger (1973) and Project Elephant (1992)

##### Key achievements

- Forest cover reached 21.76 percent of India's area (715,343 km<sup>2</sup>) in 2023 (up +156 km<sup>2</sup> since 2021); tree cover added 1,289 km<sup>2</sup><sup>109</sup>
- Carbon stock in India's forests rose by ~81.5 Mt (between 2021 and 2023)<sup>110</sup>
- Tiger population rose to 3,682 (2023) from 1,706 (2010); Elephant numbers reached ~29,964 (2017) from ~27,694 (2007)<sup>111</sup>



#### 6. Climate indicator: Glaciers

##### Key policies

- National Mission for Himalayan Ecosystem (DST, 2022)
- NDMA GLOF (Glacial Lake Outburst Flood) Guidelines (2020)

##### Key achievements

- India is piloting GLOF early warning systems post-Sikkim 2023 disaster<sup>105</sup>



## 9. Societal indicator: Agriculture and food systems

### Key policies

- National Innovations in Climate Resilient Agriculture (NICRA)
- Krishi Vigyan Kendra (KVKs) / Gramin Krishi Mausam Seva (GKMS)
- Per Drop More Crop – Micro Irrigation (Department of Agriculture and Cooperation)
- Soil Health Card Scheme

### Key achievements

- NICRA has established 448 Climate-Resilient Villages (CRVs) across 151 vulnerable districts in 28 states/UTs, demonstrating adaptive technologies for farmers against drought, flood, heat, etc. ICAR has released 2,661 varieties of crops, livestock, horticulture and fisheries tolerant to biotic and/or abiotic stresses over the last decade (2014-24) under NICRA and associated programmes<sup>112</sup>
- Under the GKMS/Agromet Advisory Services, ~43 million farmers have access to weather-based advisories (SMS/mobile/block level)<sup>113</sup>
- Over 25 crore Soil Health Cards distributed across the country<sup>114</sup>
- Micro-irrigation coverage expanded to over 83.46 lakh hectares<sup>115</sup>

### Key policies

- NDMA Urban Flood Guidelines
- AMRUT Mission (Urban Infrastructure) / Smart Cities Mission

### Key achievements

- About 772 AMRUT-funded storm-water drainage projects (INR2,140 crore) completed (as of 2024), eliminating ~3,556 urban waterlogging points and another 372 waterlogging points at the implementation stage<sup>119</sup>
- Under AMRUT 2.0, 2,713 urban water-body rejuvenation projects (INR5,432 crore) approved<sup>120</sup>



## 10. Societal indicator: Urban and Industrial Activity

### Key policies

- India Cooling Action Plan (2019)
- 'Nagar Van' Scheme (2020)

### Key achievements

- About 111 'Nagar Vans' approved against the target of 100 'Nagar Vans' in 100 Days Action Plan, Scheme Offers INR4 lakh per hectare to promote urban forests with citizen involvement across 6 States and 1 UT across the country<sup>116</sup>
- Ahmedabad, Surat, showing lower surface temperatures post Heat adaptation measures<sup>117, 118</sup>

### Key policies

- Swachh Bharat Mission-Urban (2014, SBM 2.0 in 2021)
- Solid Waste Management Rules (2016)
- Plastic Waste Management Rules (2022)

### Key achievements

- Nearly 75 percent of MSW is now processed (up from 18 percent in 2014)<sup>121</sup>
- ~1,191 ULBs are certified ODF++ (faecal sludge management)<sup>122</sup>

RBI, with the release of the 'Draft Disclosure framework for climate-related financial risks, 2024' guidelines<sup>123</sup>, is moving towards mandating compliance to climate-related disclosures. Regulated entities (the "REs") i.e. Scheduled Commercial Banks, Tier IV Primary (Urban) Co-operative Banks, All India financial institutions and Upper layer and top layer NBFCs are expected to implement robust climate-related financial risk management policies and processes to effectively counter the impact of climate-related financial risks.

This addresses the need for a better, consistent and comparable disclosure framework for REs, as inadequate information about climate-related financial risks can lead to mispricing of assets and misallocation of capital by the

REs. The guidelines mandate disclosure of information about climate-related financial risks and opportunities for the users of financial statements and is expected to foster an early assessment of climate-related financial risks and opportunities and also facilitate market discipline. The disclosures areas are on four thematic pillars of Governance, Strategy, Risk Management and Metrics and Targets. The disclosures are applicable in glide path manner starting from 2025-26 onwards.

India's institutional ecosystem is beginning to respond to the climate crisis with increasing scale and visibility. The next frontier lies in deepening local implementation, documenting and integrating local knowledge into policy, ensuring continuity and enabling adaptive capacity across all levels of governance.

# Corporate response to the climate crisis

As government policies on climate change are steadily evolving, the private sector is beginning to respond meaningfully. Though much of this action is occurring in silos, engagement is steadily growing.



## Insights from Deloitte's Corporate Climate Readiness Survey 2025

64% plan to increase climate-related investments in the next three years

**A few large corporations are emerging as climate leaders. They integrate sustainability into operations and treat climate action as central to future business growth.** This shift signals the rise

of a more evolved climate philosophy that views corporate leadership as a key driver of systemic change rather than a peripheral actor.

“Sustainability is not just a good to do, but very much an integral strategic part for businesses - a driver for significant economic value; green initiatives reduce risks, reduce costs and drive-up revenue and market cap and in turn offer a substantial IRR on investments. To scale, we need enabling policies, clear market signals and a desire to change the status quo.”

**Ankit Todi,  
Chief Sustainability Officer, Mahindra Group**

Corporate responses to climate change are shaped by motivations, falling broadly into three overlapping patterns:



- **Compliance-driven climate action:** Actions where regulations and compliance enable the business case, e.g., hazardous waste management. While they may lack a financial case, they represent **necessary actions for the continued functioning of an industry**, often linked to negative environmental externalities such as water pollution, air pollution and biodiversity protection. Policy adherence and strict implementation with necessary compliance mechanisms should be the focus here; updating regulations and guidelines to stay current with industry practice and learn from best-in-class global practices is required.



- **Commercially viable climate action:** Initiatives that deliver **clear and tangible financial benefits** and have a clear business case, with **relatively mature technology, established and growing markets** and sufficient **returns** for private capital. Herein, climate action aligns with cost savings, brand positioning, access to capital and new revenue opportunities, among other strategic considerations. Commercially viable climate action covers areas such as renewable energy and energy efficiency, which are economically and environmentally value accretive from the outset. Policy must be supported by removing obstacles to accelerate progress, bring more capital in, especially global capital and encourage technological advancement.<sup>124</sup>



- **Strategic and transformative climate action:** Corporate initiatives that go beyond compliance obligations and short-term commercial viability, positioning **climate response as a lever for long-term competitive advantage and resilience**. **These actions often shape or anticipate future policy, create new markets and redefine business models, embedding sustainability at the core of corporate strategy.** Examples include early investments in circular economy practices, green hydrogen or large-scale ecosystem restoration, where the immediate payoff may be uncertain but the long-term strategic benefit, from future readiness to reputational leadership and systemic risk reduction, is significant. These responses reflect a deeper shift in how businesses view their role in the climate transition, signalling leadership and ambition rather than obligation.

The following section showcases illustrative examples of climate action undertaken by Indian corporates and start-ups:

## Corporate case studies

### Case study 1: Aditya Birla Group

Aditya Birla Group enhances water resilience and reduces waste through infrastructure upgrades, nature-based solutions, and innovative resource repurposing

#### Company overview

Aditya Birla Group is a diversified multinational conglomerate headquartered in India, with leading businesses across sectors like metals, cement, textiles, financial services, and telecommunications

#### Evolution of climate philosophy

In the 2010s, Aditya Birla Group adopted a Risk based approach, implementing systems for air, water, and waste, and launching Sustainability Reports. In the 2020s it shifted to Business Contextualization, setting group-wide sustainability targets. Looking ahead, the Group aims to position itself as a strategic enabler of climate resilience, circularity and greener products through initiatives such as Liva Reviva and Ecocycle.

#### Key sustainability initiative

<b>Challenges</b>	<b>Water resilience program</b>
	ABG tackles water stress through strategic resilience measures such as reducing consumption, enhancing efficiency, and building climate smart infrastructure within and outside operating sites.
<b>Initiative</b>	<ul style="list-style-type: none"> <li>ABG Upgraded drainage infrastructure in coordination with local authorities to enhance stormwater handling capacity</li> <li>UltraTech Cement achieved water positivity ratio of 5 times,</li> <li>ABFRL recycled 76% of its water in FY24,</li> <li>~50% reduction in freshwater consumption per tonne of product on a FY16 baseline at critical locations</li> <li>27 operational units have achieved Zero Liquid Discharge status.</li> <li>24 out of 31 mines have achieved water positive status</li> </ul>
<b>Impacts</b>	

Hydrosphere  Atmosphere  Corporate  Community 

Source: Aditya Birla Group

### Case study 2: Godrej industries Group

Through initiatives like integrated watershed development, and regenerative agriculture, the Group integrates ecological restoration with community impact

#### Company overview

Godrej Industries Group is a prominent Indian multinational conglomerate with a rich legacy spanning over a century. The Group operates across diverse sectors including consumer goods, real estate development, agriculture, industrial engineering, and more.

#### Evolution of climate philosophy

Godrej Industries Group's climate philosophy has evolved over time. In the mid 2010s, the focus was on Compliance and Risk Management, marked by the first Sustainability Report and pollution control systems at GCPL and Agrovet units. By the mid to late 2010s, it shifted to Business Integration and Innovation, with biodegradable packaging and sustainable agriculture. From the 2020s onwards, the Group embraced Strategic Transformation and Purpose Led Growth, including smart irrigation and precision soil management.

#### Key sustainability initiative

<b>Challenges</b>	<b>Reclaim and rebuild</b>
	ABG adopted 'Waste to Wealth' approach and drives circularity by conserving resources and reducing environmental impact. Birla Cellulose (Aditya Birla Group) launched LIVA Reviva that promotes circular economy in the textile
<b>Initiative</b>	<ul style="list-style-type: none"> <li>LIVA Reviva uses pre-consumer cotton waste + wood pulp, which leads to significantly lower greenhouse gas emissions and water usage compared to standard (virgin) viscose</li> <li>Recycles pre-consumer textile waste that might otherwise go to landfill / incineration</li> <li>Liva Reviva is enabled with blend of 30% textile waste and wood pulp</li> <li>Birla Cellulose disposed of nearly 90% waste through recycling or reuse in FY24.</li> </ul>
<b>Impacts</b>	<p><b>Integrated watershed development</b> </p> <p><b>Drought and water scarcity</b> in key Agri-regions made Godrej's operations vulnerable</p> <p><b>Low-cost watershed development</b> Partnered with NABARD to scale groundwater recharge in drought-prone region</p> <p><b>Over 10,000 ha of land area developed</b></p> <p><b>50 Mn m3</b> of water captured by FY24 – 25, 13 times the company's water consumption</p> <p><b>4 tons oil/ha Yields achieved as compared to national average of 3 – 3.5 tonnes/hectare</b></p>

 Lithosphere  Hydrosphere

Community  Government 

Source: Godrej Industries Group

### Case study 3: Gainwell India

Gainwell advances sustainability through its UNNATI green facility and the Reclaim & Rebuild program, focused on energy efficiency and circularity

#### Company overview

Gainwell India is a leading provider of Caterpillar equipment and integrated solutions across construction, mining, and energy sectors. With over 80 years of experience, it offers machines, power systems, and comprehensive after-sales support.

#### Evolution of climate philosophy

In the early 2010s, Gainwell focused on Compliance & Safety Foundations, embedding EHS systems and legal compliance. By the mid to late 2010s, it moved to Operational Integration & Efficiency with the UNNATI LEED-certified facility and sustainability upgrades. From the 2020s onwards, it emphasised Leading with Technology & Circularity, partnering with World Coal Association and scaling component remanufacturing.

#### Key sustainability initiative

##### Reclaim and rebuild

#### Challenges

Heavy equipment often discarded after decades - high cost, high resource use, and emissions associated with new manufacturing

#### Initiative

- The program extends asset lifespan via comprehensive overhaul, restoring performance at fraction of new cost
- Leverages circular economy via remanufacturing: reuse of steel and parts to conserve resources and reduce emissions
- Aim is to get both the material and water usage down to 70%

#### Impacts

- 2,000+ tonnes** of steel/iron saved from scrap, avoiding waste and carbon footprint
- 60%** used parts in every rebuilt machine, with no additional carbon footprint compared to new parts.
- 8,000-20,000** hours of extended machine life, lowering overall environmental impact.

##### Navigating UHI through Unnati



Corporate offices in Greater Noida needed a zero-emission, ultra-efficient workspace that embodied sustainability

- Achieved LEED v4 Platinum certification, through full-building life-cycle assessment and recycled materials
- Integrated radiant cooling with tempered fresh air, advanced shading, green roofs
- Treated and reused grey water and rainwater onsite
- ~13%** reduction in embodied carbon
- ~50%** Lower HVAC Energy load
- ~70%** Water recycling achieved onsite

### Case study 4: Mahindra Group

Mahindra Group integrates sustainability into core business strategy, focusing on carbon neutrality, water positivity, and regenerative agriculture

#### Company overview

Mahindra Group is a global federation of businesses (India headquartered), operating across 20+ industries with core business in auto & farm sectors. Additionally, services span across diverse industries incl. tech, finance, RE, real estate, hospitality, logistics etc.

#### Evolution of climate philosophy

Mahindra's journey started in the early 2000s with building Foundation and Compliance, publishing Sustainability Reports from 2008. In the 2010s, it advanced to Integration & Innovation, investing in renewable energy and sustainable agri-solutions. From 2019 onwards, it focused on Building Momentum on Nature, by Business for Nature, targeting carbon neutrality by 2040 and expanding the EV ecosystem.

#### Key sustainability initiative

##### Biodiversity transformation at Igatpuri Plant



##### Challenges

The engine manufacturing plant at Igatpuri (Maharashtra) had limited green area, resulting in high dust levels, erosion, and low biodiversity

##### Initiatives

- Planted over **80,000 trees and 29 species of shrubs**, and created butterfly and botanical gardens
- Implemented water conservation measures to support biodiversity and green cover

##### Impacts

- ~63% Increase** in green cover (from 25%)
- ~75% Reduction** in dust levels and
- 2°C** decrease in ambient temperature

##### Regenerative agriculture



##### Regenerative agriculture

Soil erosion, water scarcity, and declining farm productivity threatened sustainable agriculture

- Innovative Equipment & Irrigation: No-till seeders and micro-irrigation save water, energy and protect soil health
- Early-Maturing Seeds: Crop varieties that reduce water and fertilizer use
- Organic Crop Protection: Biological products ensure residue-free, sustainable farming

- 1 million tonnes** of carbon sequestered
- 33 billion litres** of water conserved through micro-irrigation systems
- 8.4 MU** energy savings estimated in FY25

##### End of life vehicle recycling



22 Mn vehicles will reach the end of their operational life by 2025 - emit up to 8X more pollutants

CERO (JV with MSTC Ltd) - India's 1st authorized vehicle recycling system:

- ELV dismantling with eco-friendly recovery
- Maximizes metal recycling to reduce virgin material use
- India's largest network in 45 cities (RVSFs & customer touchpoints)
- 30,000 +** ELVs recycled to date
- 31,000 +** tonnes of iron ore saved
- 20,000 +** tonnes of ferrous scrap recovered

Lithosphere Hydrosphere Atmosphere Corporate NGO Community Government

Source: Gainwell India

Lithosphere Hydrosphere Atmosphere Corporate NGO Community Government

Source: Mahindra Group

## Case study 5: Thermax Limited

Thermax delivers integrated solutions for cleaner air, efficient energy, and sustainable water management — powered by digital technologies that drive smarter, more reliable industrial performance.

### Company overview

Thermax is a leading provider of energy & environment solutions, serving industries globally with its extensive portfolio across power, heating, cooling, air pollution control, water and wastewater management. With nearly six decades of expertise, it delivers future ready solutions, backed by innovation and strategic collaborations.

### Evolution of climate philosophy

Thermax began in the late 2000s – early 2010s with Environmental & Regulatory Compliance, installing ETPs and emission controls. In the mid to late 2010s, it focused on Operationalizing Sustainability through energy-efficient boilers. From the 2020s onwards, it embraced Innovation-Led Sustainable Growth, aiming for 50% carbon reduction by 2030 (vs. FY19) and introducing circular economy solutions.

### Key sustainability initiative

Wind, solar and hybrid captive power plants across india



Biomass steam boilers for an fmcc major in gujarat, india



Electrical heat pump enables sustainable heating for vietnam's textile major



### Challenges

To meet customers' captive energy needs while enabling cleaner, more sustainable power to support the decarbonisation of their industrial operations.

### Initiative

- Thermax commissioned 225 MWp of solar, wind and hybrid projects spread over multiple sites in the states of GJ, TN and MH
- Deployed modules over 3.25 lakhs in number, plus twenty units of 3 MW class WTGs

### Impact

- 4,00,000 tonnes of CO2-e emissions avoided
- 225 MWp of renewable energy capacity deployed for industrial operations

Lithosphere Atmosphere

Corporate

Source: Thermax Limited

## Case study 6: Aarti Industries Limited

Aarti Industries Limited (AIL) strengthens its waste, water, and energy management through strategic investments in renewable energy, advanced treatment technologies, and sustainable operational practices.

### Company overview

AIL is a leading Indian specialty chemicals company focused on benzene, toluene downstream, and sulphuric acid value chains, catering to global markets across agrochemicals, dyes & pigments, polymers, pharmaceuticals, and energy sectors.

### Evolution of climate philosophy

Aarti Industries started publishing standalone sustainability report from FY19 and is committed to Net Zero by 2050. It has invested in the areas of clean energy, water management, has embraced circularity by reducing waste and has set future sustainability targets across several areas.

### Key sustainability initiative

#### Waste management & recycling



#### Challenges

Mismanaged plastic and hazardous waste - rooted in fossil-based production and worsened by open burning and leakage - releases GHGs and toxic pollutants that contaminate air, water, and soil, degrading ecosystems, harming health, and imposing significant economic costs.

#### Initiative

- Over 50% of manufacturing units are currently Zero Waste to Landfill (ZWL) certified, with a target to achieve 100% certification by FY28
- Authorised waste disposal vendors** selected by auditing before starting disposal of waste

#### Impacts

- 90%** hazardous waste recycled/recovered
- 4%** hazardous waste co-processed
- 26% of the total raw material requirement is met through the internal reuse of generated hazardous waste
- 0** major Tier-1 chemical spills reported

#### Water management & recycling



Inefficient water and effluent management drives pollution and public-health risks, depletes vital freshwater sources, harms ecosystems and agriculture, and imposes economic costs - making robust water and effluent management essential.

#### 50% Manufacturing units are Zero Liquid Discharge compliant

with 8 ZLD units and another 3 units are ZLD-ready established greener

#### Water Risk Assessment

for all units

#### Rainwater Harvesting, Greywater Recycling, Treated Wastewater

being reused

#### ~42% Water Recycled

amounting to ~1.2 Mn kL of water recycled

#### 8.24% of water consumption from desalinated sources

4.37% reduction in specific water consumption from FY19

100% of wastewater undergoes in-house treatment

Lithosphere Hydrosphere

Corporate

Source:Aarti Industries Limited

## Case study 7: Pidilite Industries Limited

Pidilite enhances waste management, water assets and energy management through its community water stewardship and energy infrastructure upgrade programmes

### Company overview

Pidilite is the leading Indian consumer and speciality chemicals manufacturer headquartered in Mumbai (known for Fevicol and Dr. Fixit). Its product range includes adhesives and sealants, waterproofing and construction chemicals, art and craft materials, industrial resins and pigments.

### Evolution of climate philosophy

Pidilite has published standalone Sustainability Reports since FY19. It is consistently expanding its renewable energy footprint and increasing installed capacity each year. Since 2022, the company has been reducing the use of virgin plastics. Pidilite also leads community watershed management initiatives and promotes advanced agricultural and horticultural practices. It is actively tracking progress towards its Target 2030 Sustainability Goals.

### Key sustainability initiative

Energy transition and efficiency	Community water stewardship	Circularity and waste reduction
<b>Challenges</b> <p>Usage of energy in manufacturing and power generation is still fossil-heavy, and decarbonising manufacturing processes is a difficult task</p>	<b>Challenges</b> <p>India has high water stress and water scarcity in semi-arid districts, coupled with erratic monsoons lead to low farm productivity and put strain on farmers' livelihoods, making community water assets vital for their livelihoods</p>	<b>Challenges</b> <p>Mismanaged plastic and hazardous waste fuels climate and ecosystem harm with fossil-based production and open burning releases GHGs, while leakage contaminates soil and water with toxic chemicals</p>
<b>Initiative</b> <ul style="list-style-type: none"> <li>Switched boiler fuels to briquettes and less carbon-intensive fuels such as PNG. Expanded renewable electricity footprint by investing in windmills and solar farms</li> </ul>	<ul style="list-style-type: none"> <li>Built and restored community water assets (check dams, ponds, farm ponds) and repaired canal links while scaling micro-irrigation</li> <li>Collaboration with the Government of Gujarat in the Bhavnagar and Amreli districts of Gujarat</li> </ul>	<ul style="list-style-type: none"> <li>Waste management and recycling are implemented through the EPR plan and processed by CPCB-authorised recyclers</li> <li>Co-processing of waste through cement plants, reusing of wash water and process effluents</li> </ul>
<b>Impact</b> <ul style="list-style-type: none"> <li>About 47 percent of energy usage comes from renewables</li> <li>Nearly 14 percent YoY reduction of fuel energy consumption</li> <li>About 9 percent YoY reduction of electricity consumption</li> </ul>	<ul style="list-style-type: none"> <li>~6,500 ha of farmland converted to micro-irrigation across 100 villages</li> <li>About 1,800+ community check dams and ponds have been constructed</li> </ul>	<ul style="list-style-type: none"> <li>About 100 percent of plastic packaging introduced by the company to the market is collected and recycled from post-consumer waste</li> </ul>

Lithosphere   Hydrosphere   Atmosphere   Corporate   Community

Source: Pidilite Industries Limited

## Start-up case studies

**Indian start-ups, with their innovation-first mindset, are rapidly emerging as critical catalysts in India's climate response.** These ventures are reimagining solutions across waste management and smart farming initiatives. They are forging collaborations with corporates, government bodies and investors, unlocking new opportunities for pilots, co-development and scaled deployment.



“It is imperative to broaden the perspective and go beyond viewing climate action as a compliance obligation to embracing it as a driver of real, systemic impact. The most agile players are no longer waiting at the sidelines and being risk-averse; rather, they are taking bold steps for transformative impact at scale along with collaborators who believe in learning by doing.”

**Rupali Mehra**

**Chief Marketing Officer and Head of Asia, Spowdi**



## Case study 1: Spowdi

### Solar-Powered Mobile Irrigation System for Small-Scale Farmers

#### Company overview

A greentech company (India-Sweden JV, Sweden headquartered with 100% India subsidiary) delivering solar-powered drip irrigation systems for small-hold farms - lightweight, portable, and emission-free - enabling precise irrigation for up to 1 acre using only solar power and saving up to 80% water compared to traditional methods

#### Challenges

- Small-scale farmers produce about one-third of the world's food but face severe challenges including climate shocks, limited access to efficient irrigation, low productivity per acre and depleting water tables. Traditional irrigation systems are energy and water intensive (typically 1HP+), and often unsuitable for land sizes of smallholder farms

#### Implementation model through partners

 Collaborates with implementing organisations, farmer groups, and financial institutions on a scalable structured Smart Farming initiatives with recorded impact data

 Farmers gain through intensive training, entrepreneurship opportunities, increased production and higher income; soft financing ensures affordability and long-term sustainability

#### Technology and solution

##### Spowdi focused on enabling water-efficient, climate-resilient farming

- Developed a patented, lightweight, solar-powered mobile irrigation system operating on just 0.1 HP, vastly more efficient than conventional 1 HP+ pumps.
- Designed for mobility to serve multiple small farms with minimal setup

##### Projects across multiple water scarce areas in India

- Focusing on sustainable farming practices using shallow water sources, rainwater harvesting, to allow ground water recharge.

 Hydrosphere

 Community

Source: Spowdi

## Case study 2: Indra Water

### Redefining Wastewater Management with Compact & Sustainable Solutions

#### Company overview

A Mumbai-based cleantech startup founded in 2018, Indra has indigenously developed ElectroX, a compact, and automated electrochemical wastewater treatment solution. These plug-and-play units recover up to 95% of water, reduce sludge by 70% and shrink plant footprint by 90%

#### Challenges

- India generates around 72,368 MLD of sewage, but only about 28% is effectively treated, leading to widespread water contamination
- Rapid urbanization has overwhelmed aging infrastructure, causing untreated effluents to pollute rivers, lakes, and groundwater

#### Significant projects

-  Installed a **1,600 KLD Effluent Treatment** Plant at Unilever Oleochemical Indonesia for personal care product wastewater stream
-  Deployed around **25+ installations** across the globe and a ~2.5+ MLD water and wastewater treatment plant in installation phase in Mexico & Egypt with Unilever
-  Deployed a **250 KLD Sewage & 80KLD Laundry Effluent treatment plant** at Taj Mahal Palace, Mumbai, a flagship commercial property of IHCL Group

#### Impact

~95%	liters of water treated by Indra so far
~ 10,000 +	tonnes of harmful sludge reduced till date with Indra solution as compared to chemical treatment
~ 9,000 +	tonnes of hazardous chemicals saved to date with Indra solution in comparison to conventional approaches
~95%	water recovery at installations in commercial & industrial properties to offset freshwater requirement
~74%	potential carbon offset as compared to conventional treatment methods

 Hydrosphere  Corporate

Source: Indra Water

### Case study 3: Saahas Zero Waste

Professional waste management for companies, enterprise customers, townships etc.

#### Company overview

A Bengaluru-based social enterprise offering end-to-end zero-waste solutions for bulk waste generators across major Indian cities. Manages over 100 tons of waste daily, helping clients achieve up to 96% landfill diversion through segregation, processing, and recycling.

#### Challenges

- Inadequate enforcement of policy
- Insufficient authorised end-destinations
- Inadequate segregation of waste at source, leading to lower material recovery

Significant projects	Impact
<ul style="list-style-type: none"> <li>• <b>Ecoworld Tech Park:</b> On-site decentralized unit managing 1.5-2 TPD wet waste; dry waste segregated across 10+ office blocks</li> </ul>	~95% Landfill diversion improved from 40% while processing 350+ tons of waste monthly; compost is reused in landscaping across the SEZ
<ul style="list-style-type: none"> <li>• <b>Thapar Institute of Engineering and Technology (TIET):</b> Integrated Solid Waste Management Unit set up on-site, formalised 21 waste workers, behavioural change</li> </ul>	~90% Diversion from landfill achieved so far
<ul style="list-style-type: none"> <li>• <b>Rain Cements:</b> Implemented door-to-door source segregation and built integrated waste management units with composting and dry waste processing</li> </ul>	~100% Fully stopped waste dumping and burning; transitioned to resource recovery mode, with compost reused and dry waste sent to authorized recyclers
<ul style="list-style-type: none"> <li>• <b>Hindalco (Belagavi &amp; Muri):</b> Established integrated solid waste management units with in-vessel composters and dry waste segregation, launched awareness campaigns, and trained staff to institutionalize circular systems</li> </ul>	~84% Diversion of waste; 20,264 kg waste collected, sorted, aggregated and resources recovered, 9,206 kg compost produced

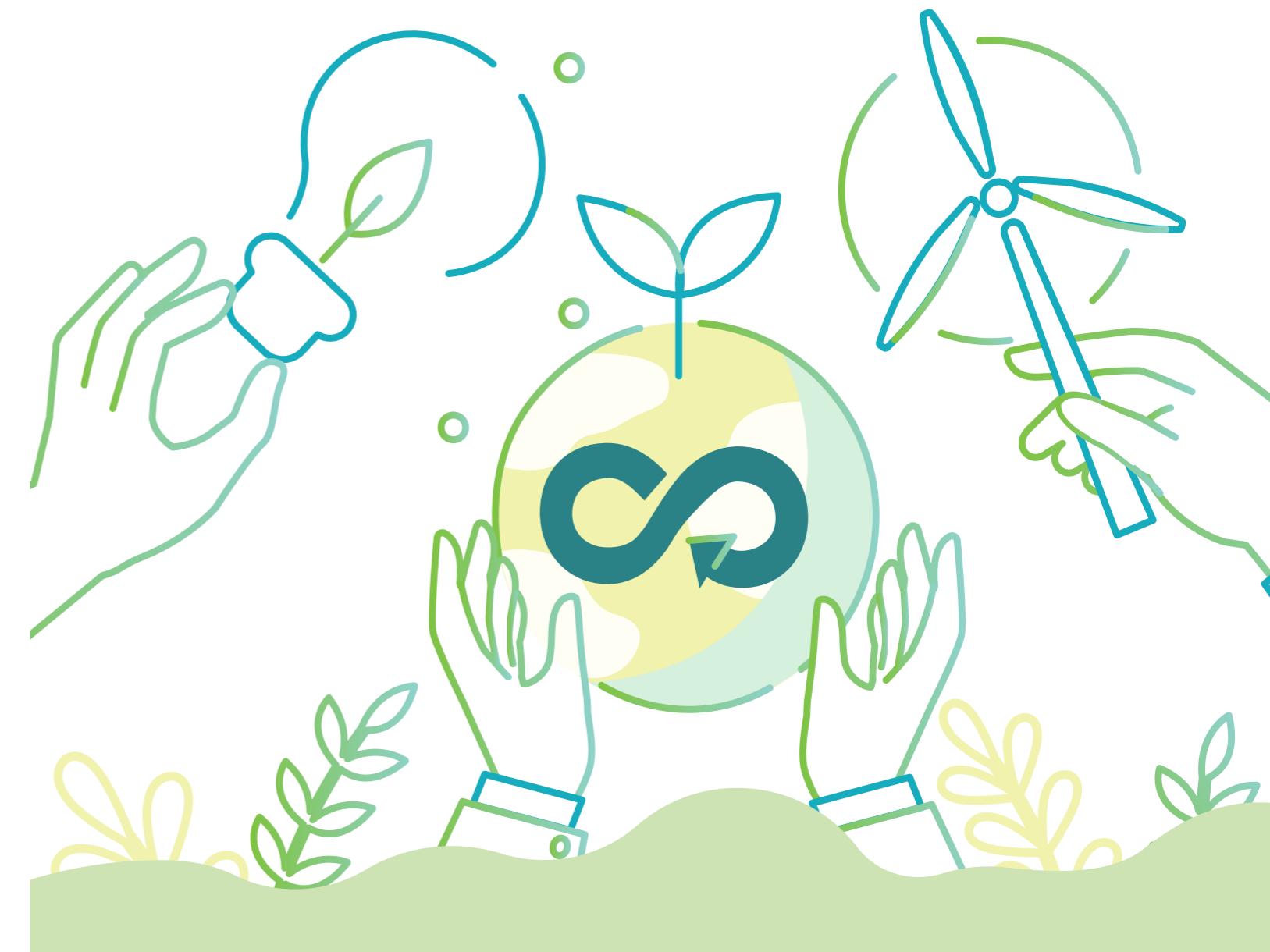
Hydrosphere

Lithosphere



Source: Saahas Zero Waste

## Civil society response to the climate crisis



Climate change affects every citizen and community across the country. While corporations and governments play vital roles in driving systemic change, numerous examples show how civil society organisations and citizen groups actively address hyperlocal challenges. These groups understand that many issues demand solutions tailored to local contexts, particularly where institutional reach is limited. As such, they are uniquely positioned to make meaningful contributions towards positive change. The following section presents select illustrative case studies where civil society initiatives have successfully scaled impactful, on-the-ground climate solutions.

## Case study 1: Paani Foundation

Non-profit, non-governmental organization active in the area of drought prevention and watershed management in the state of Maharashtra

### Company overview

Paani Foundation is a non-profit, non-governmental organization which is active in the area of drought prevention and watershed management in the state of Maharashtra

### Challenges

- Paani Foundation seeks to tackle the chronic drought crisis in rural Maharashtra by addressing both water scarcity and unsustainable agricultural practices
- The challenge lies in motivating farmers to adopt water-wise and sustainable methods by linking ecological restoration with direct, measurable improvements in their livelihoods.

Initiative	Impact
<b>Satyamev Jayate Water Cup" by the Paani Foundation</b>	6,000+ In food production for smallholder farmers using the Spowdi system
	7,006 km Length of continuous contour trenches (CCTs) built
	550 billion liters Of water storage capacity created from 2016-2019, across 76 talukas
	55,000+ Villagers trained in a 4-day residential training

Hydrosphere  Community  Government 

Source: Paani Foundation

## Case study 2: Waste Warriors in the Indian Himalayan Region

Building Climate-Resilient Communities through Decentralized Waste Solutions

### Company overview

Waste Warriors is a community-based NGO dedicated to systemic waste management across the Indian Himalayan Region, focusing especially on high-tourism areas in Uttarakhand and Himachal Pradesh where over 60% of waste is dumped or burned.

### Challenges

- The Indian Himalayan Region generates 8.4 million metric tons of waste annually, with over 60% dumped or burned - causing black carbon emissions, glacier melt, and ecosystem damage.
- Tourism and weak local infrastructure intensify the crisis

Initiative	Impact
<b>Waste Warriors focused on decentralized waste systems, climate education, and green livelihoods via:</b>	3614+ MT of waste diverted from landfills.
 • Built waste management systems through training, infrastructure, and coordination, primarily in rural areas	25+ Waste management infrastructure established, including 5 Material Recovery Facilities and 20+ Waste Banks
 • Engaged communities and youth with awareness campaigns and educational programs.	~1.5 Lac People enabled to voluntarily take climate-positive actions
 • Supported policy improvements and empowered waste workers, especially women, through formal jobs and recycling income.	60000+ Days of Dignified Livelihood for our green workers
	200+ Local Partnerships created across 50+ Gram Panchayats

Hydrosphere  Community  Government 

Source: Waste Warriors in the Indian Himalayan Region

Policy reforms, corporate action, and local innovation are advancing coordinated climate efforts. Yet the scale and urgency of the challenge demand more. Climate readiness must now become a shared national endeavour, driven by strong governance, sustained collaboration, innovation and inclusivity.

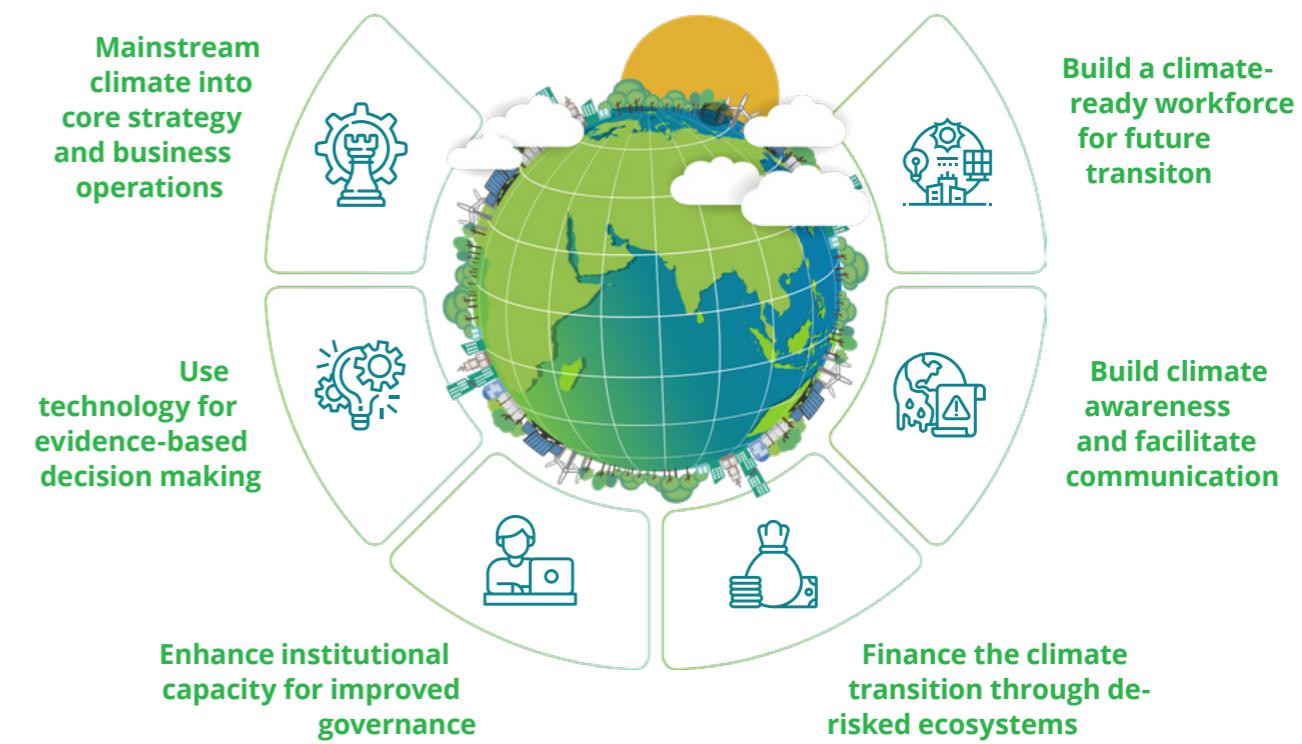


## Way forward: Pathways to climate resilience

India's climate efforts must evolve into a unified strategy that engages all stakeholders. As India stands at the crossroads of development and sustainability, a coordinated, forward-looking approach is essential to address the scale and complexity of climate risks.

As momentum builds across sectors, the next phase of climate action must focus on coherence, coordination and creativity. This means not only scaling existing solutions but also redesigning the systems that shape how capital flows, how businesses operate and how communities adapt. India's focus, therefore, must now shift towards advancing priority pathways that bring together policy, finance, technology and collaboration, creating an integrated framework for resilience and low-carbon growth.

### Strategic pathways for India's climate resilience



“This is an opportunity for India to get it right by embedding sustainability, innovation and resilience at the core of its industrial and economic progress.”

**Mirik Gogri**  
Head of Growth, Aarti Industries Limited

The following sections delve deeper into each pathway, highlighting how coordinated action across these areas can drive India's climate resilience agenda forward:

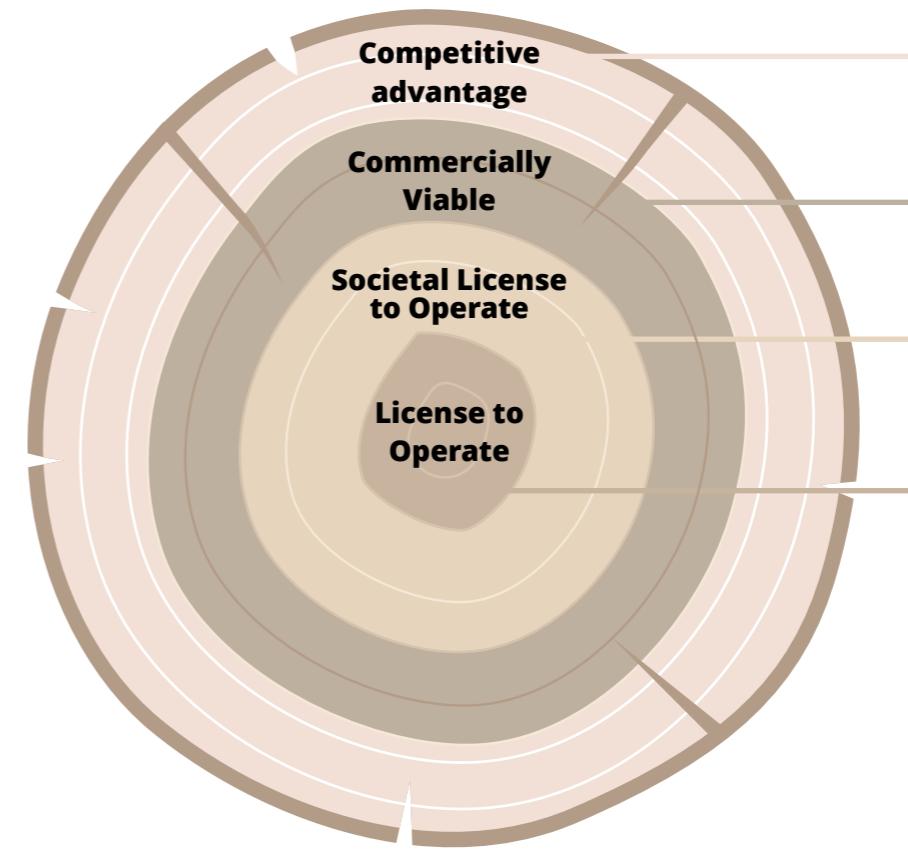


### Mainstream climate into core strategy and business operations

Making climate central to business and policy strategy will be essential for building long-term resilience and competitiveness. By integrating risk and opportunity assessments into planning, investment and governance, companies can better anticipate disruptions and strengthen decision-making. Further, embedding board-level accountability and linking leadership KPIs to climate performance builds ownership and drives consistent action across organisations. In parallel, decarbonising operations, building resilient supply chains, and aligning disclosures with global frameworks help ensure transparency and investor confidence.

To translate these actions into sustained outcomes, businesses require a structured approach that links climate action directly to strategy, governance, and performance. A helpful way to think about this is through a Corporate Climate Action Framework, which will enable organisations to act across four concentric circles simultaneously. Each circle represents a distinct but interconnected domain of influence and responsibility:

### Corporate climate action framework



*Pursue transformative innovation for environmental and societal benefit*

*Invest in solutions with clear business cases and market demand*

*Build trust with communities, employees, and stakeholders*

*Meet regulatory requirements; ensure compliance in core operations*



- **License to operate:** At the core, companies must comply with regulations and meet minimum standards for continued operation - adhering to environmental laws, fulfilling reporting obligations, and embedding climate risk into business processes. Strong compliance systems safeguard continuity, mitigate risk, and form the foundation for all future climate action.

- **Societal license to operate:** Beyond compliance, companies must build trust and legitimacy with communities, employees, and customers. This involves transparency, responsible sourcing, and investments in community and workforce well-being. Earning this societal license enhances reputation, talent attraction, and long-term stakeholder support.

- **Commercially viable:** Here, climate action aligns with business value - scaling proven technologies, innovating products, and optimizing supply chains for efficiency and growth. These efforts deliver measurable returns through cost savings, revenue growth, and competitive advantage.

- **Competitive advantage:** At the outermost level, companies pursue transformative innovation and partnerships that create lasting environmental and societal impact. Investing in R&D, new business models, and systemic change builds resilience, shapes future markets, and delivers enduring sustainable value.

As businesses look to scale such innovation, there is significant opportunity for value creation by investing early in emerging climate technologies. Deloitte's GreenSpace initiative, tracking over 7,000 climate innovations globally, covers six critical domains shaping the next wave of climate solutions – Transport, Clean Energy, Agriculture, Food and Land, Built Environment, Heavy Industry, and Carbon Management.<sup>125</sup>

**These circles are interconnected and mutually reinforcing.** Adopting this layered approach ensures climate action is aligned with enterprise value and contributes meaningfully to India's broader sustainable development.

“While large companies have embedded climate action into their core business operations, most Indian corporates are still in the early stages and haven't accounted for the impacts and risks of climate change to their business and operations”

**Nadir Godrej**  
Chairman and Managing Director, Godrej Industries Group



## Leverage technology to scale impact

### Investing in Digital Public Infrastructure (DPI) and open networks:

- India's success with open, interoperable systems, such as Unified Payments Interface (UPI) and Open Network for Digital Commerce (ONDC), shows how Digital Public Infrastructure (DPI) can unlock innovation and scale. Extending this approach to climate systems can help address persistent barriers, such as fragmented data, high coordination costs, and siloed, purpose-specific solutions. Climate-focused DPI can connect stakeholders across sectors – such as energy, agriculture, waste, and water systems – enabling transparent, verifiable, and efficient exchanges of data, services, and resources. The Digital Energy Grid (DEG), a collaborative vision with the International Energy Agency and Beckn Labs, exemplifies this approach in action, having already facilitated over 6 million transactions and dispersed more than 32.56 GWh of energy, demonstrating how coordinated digital infrastructure can transform energy systems at scale.
- Open network protocols, such as Beckn, reveal how digital infrastructure can become a powerful enabler of climate action and sustainability at a planetary scale. By making systems open, interoperable and inclusive, such networks can unlock entirely new forms of collaboration across sectors – from connecting agri-waste suppliers, refineries, and aviation companies to accelerate sustainable fuel production, to powering decentralized energy grids that enable transparent, peer-to-peer renewable energy exchange and flexible demand response. By creating a secure digital footprint of climate actions, these networks can also eliminate double counting of mitigation benefits, ensuring integrity, traceability, and trust across sustainability value chains. They can also weave together diverse climate data streams into interoperable layers of intelligence; for instance, integrating water intelligence across sectors and stakeholders would equip farmers, city planners, industries, and communities with real-time insights, enabling smarter irrigation, urban water management, and resource planning. Together, these open networks form the foundation of a digital commons where information, incentives, and innovation flow freely to drive coordinated climate action for the whole of humanity.
- Integrating interoperable digital infrastructure into national and subnational climate strategies – like SAPCCs, or city-level climate plans – can help shift India from fragmented digital pilots toward a connected, ecosystem-level architecture, enabling more coordinated and data-driven climate action.

## Embedding AI across the infrastructure lifecycle – planning, response, and recovery:

- Building infrastructure resilience is among the most cost-effective climate strategies, with benefits ranging from three to fifty times the costs in avoided damages and disruptions. By 2050, average annual global losses from natural hazards are projected to reach nearly US\$460 billion – double the current average. Integrating artificial intelligence (AI) into infrastructure systems could reduce these losses by an estimated US\$70 billion per year, or 15% of projected costs.<sup>126</sup>
- For India, embedding AI into critical infrastructure sectors, such as transportation, energy, water, telecom, and agriculture can significantly improve risk anticipation,

reduce service disruptions, and strengthen economic and social resilience. AI has the potential to enhance resilience across all phases of hazard management – before, during, and after disruptive events. To fully harness the potential, cities and states will have to prioritize data quality and accessibility. This includes creating and maintaining well-structured data repositories and dashboards, conducting robust city-level baseline assessments, and making non-sensitive GIS layers publicly available. Coordinated investment in digital infrastructure, interoperable data systems, and public-private innovation frameworks will be key to scaling AI adoption and enabling evidence-based, resilient climate action.

## Reliable, accessible and actionable data forms the backbone of effective climate action.

- India must invest in strengthening its climate data infrastructure, closing critical information gaps and enabling real-time monitoring, reporting and verification. While academia and research institutions are well-placed

to design robust data methodologies and tools, their efforts must be matched by public and private funding, as well as enabling ecosystems that support open data platforms and cross-sectoral integration.



## Strengthen policy coherence and institutional capacity

### Strengthen mandates and coordination for state-level governance:

- Institutions need to embed mechanisms and processes that enable routine planning, prioritization, and implementation. This can include establishing dedicated cells, departments, or working groups with cross-departmental coordination responsibilities. Identifying a nodal agency for climate-related interventions is crucial, as is clarifying mandates and assigning responsibilities across sectors.

For instance, Maharashtra's Climate Change Cell<sup>127</sup> and reconstituted Climate Change Committee, and Assam's Climate Change Management Society<sup>128</sup>, provide scientific data, expert analysis, and strategic coordination necessary to manage local climate impacts effectively. These structures also support the effective implementation of actions under India's National Action Plan on Climate Change.

### Build capacity, provide resources, and strengthen technical skills:

- Institutions require skilled workforce to implement climate priorities effectively. A Training Needs Assessment can help identify gaps at both senior leadership and ground staff levels, informing the development of context-specific training manuals and programmes. Capacity-building efforts should cover technical knowledge, project management, and soft skills

such as leadership and cross-sector coordination. Ensuring that both senior leaders and frontline staff are equipped with the right skills and tools increases the likelihood of sustained, effective climate action. Complementing training with handholding, mentoring, and on-the-job support ensures that staff can apply their skills in real-world decision-making and programme delivery.

### Implement adaptive monitoring, feedback, and learning systems:

- Building resilient institutions requires mechanisms to track progress, evaluate performance, and continuously adjust strategies. Robust monitoring frameworks can link planned interventions to measurable outcomes, track expenditure and resource allocation, and assess effectiveness over time. Institutionalizing such adaptive governance within SAPCCs, city missions, and state programs can move India beyond one-off projects

toward a sustained, evidence-based approach to managing climate risk. For example, Tamil Nadu's District Climate Mission<sup>129</sup> integrates climate adaptation across all 38 districts, establishes cross-departmental coordination, engages local communities in decision-making, and builds capacity for iterative adjustments to sectoral plans, demonstrating a fully institutionalized, state-wide learning system.



## Finance the climate transition through innovative channels and credible signals<sup>130</sup>

### Strengthen climate investment ecosystems by reducing risk and aligning incentives:

- Scaling climate investment requires reducing uncertainty and aligning incentives across the ecosystem. Blended finance mechanisms, credit guarantees, and strategic project pipelines can help lower perceived risks and attract diverse capital sources. Standardising green taxonomies and disclosure norms will build investor confidence and reduce ambiguity. While

financial and technological capital exist, their deployment hinges on compelling green business cases and enabling conditions. To unlock investment at scale, stakeholders must create clear market signals, supportive policies, and a strong desire to challenge the status quo—positioning sustainability as a strategic driver of economic value.

### Channel capital through innovative structures:

- Mobilising climate capital will require moving beyond traditional green funds and strategically repurposing existing sectoral investments towards high-impact, climate-aligned projects. Instruments, such as blended finance, transition finance, green bonds, and climate venture funds can direct resources into priority areas, such as renewable energy, sustainable transport, water, biofuels, and green

hydrogen (sectors with a combined investment potential exceeding US\$1.5 trillion by 2030). “One-Fund” and pooled investment platforms can streamline access and efficiently match capital to opportunities across sectors and maturity stages, helping aggregate fragmented capital and channel it toward scalable, systemic transformation.

## Build institutional trust through transparent governance and collaborative delivery:

- Building trust in climate finance requires transparent governance, robust measurement frameworks, and strategic collaboration across stakeholders. Strategic pipeline development will be critical to ensure capital flows efficiently toward projects with the greatest potential for scalable, systemic impact. Institutions, such as the International Solar Alliance (ISA), Global Biofuels Alliance (GBA), and the National Bank for Financing Infrastructure and Development

(NaBFID) are already mobilising capital and technical support for green infrastructure. Further, compliance-linked mechanisms like the Carbon Credit Trading Scheme (CCTS) and the Perform, Achieve and Trade (PAT) programme help strengthen accountability and investor confidence. Hence, strengthening institutional capacity at both national and sub-national levels will be essential to coordinate, monitor, and deliver climate action effectively.



## Build climate awareness and facilitate inclusive communication

### Investing in climate literacy and behavioural change communication interventions:

- Investing in climate literacy across educational institutions, media, and community programmes, and translating technical concepts into accessible messages can help inspire behavioural change. Storytelling,

participatory campaigns, and transparent communication should be used to build a shared public understanding of climate risk and responsibility, fostering collective ownership of climate action.

### Using digital and multi-channel communication tools:

- Using India's digital capabilities and a mix of traditional media, social platforms, and innovative digital channels can help expand the reach and impact of climate communication. Interactive tools – such as dashboards, mobile applications, and localized digital campaigns – can make climate

data more accessible, translate information into actionable insights, and complement on-ground outreach efforts. This approach can enable timely, inclusive, and evidence-based communication, empowering stakeholders to make informed climate decisions.

“When infrastructure, information and financing are aligned effectively, climate risks can be substantially mitigated; if not entirely averted”

**Krithika Viswanathan**  
Business Development Lead, Saahas Zero Waste

### Crop residue management programme: Mobilizing climate action through awareness and engagement



**Problem statement:** Burning of crop residue is a major environmental problem in North India



#### Communication and outreach campaigns

- Radio campaigns and digital vans were deployed across rural regions
- Over 2.5 lakh WhatsApp messages were sent to farmers
- 75,000+ IEC kits were distributed with focused communication
- Door-to-door campaigns were conducted, which reached more than 1 lakh farmers
- Superseder demonstrations with Gaushalas were conducted to extend outreach and drive adoption



#### Digital platform and ecosystem integration

- Krishi Yantra Saathi served as a digital aggregation platform for booking CRM equipment and services
- The app was customized for regional languages (e.g., Punjabi) and supported real-time booking and service delivery
- Brought together stakeholders, including farmers, equipment owners, private players, and end-user industries (bio-energy plants, paper mills)
- Across Haryana and Punjab, 1.5 lakh farmers registered; and 80,000+ CRM services availed

### Deloitte's Crop Residue Management (CRM) programme:

- A central pillar of Deloitte's Crop Residue Management (CRM) programme has been the strategic investment in climate awareness and inclusive communication. It was implemented at scale, covering 1,116 villages in Haryana and 17 villages in Punjab.
- Through extensive outreach such as radio campaigns, digital vans with screens, WhatsApp messages, and animated videos - the programme translated technical solutions into accessible, relatable messages for farmers and communities. Storytelling and community engagement were at the heart of these efforts, with

door-to-door campaigns, village rallies, and public pledges inspiring behavioural change and building a shared understanding of climate risks. The CRM initiative's success in reducing stubble burning, improving air quality, and increasing farmer incomes demonstrates how transparent, multi-channel communication and targeted education can mobilize public action and foster climate responsibility at scale. It highlights the potential of communication-led interventions to bridge the gap between policy intent and on-ground adoption.

### Impact of CRM programme in Haryana and Punjab



**~5,00,000 tonnes**

reduction in stubble burnt



**~10,00,000 tonnes**

decreased in CO<sub>2</sub> emissions



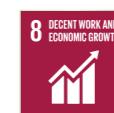
**US\$ ~14 million**

Increase in farmers' income



**~10,350 lives saved**

#### Alignment with SDGs





## Build a climate-ready workforce through education, reskilling, and collaboration

### Integrate green skills into education and skilling systems:

- Embedding green skills into education systems is essential to prepare India's workforce for the demands of a low-carbon economy. Introducing sustainability modules in schools and vocational programs will help create early awareness and build foundational knowledge. Corporate learning platforms can integrate green competencies to ensure mid-career professionals remain relevant. This can

help India meet domestic targets and make its workforce globally competitive in green sectors, such as EVs, solar energy, and circular economy. Studies show a significant portion of 65.3%<sup>131</sup> (aged 15-59) have not received any vocational or technical training, and only 5.9 percent of jobs in India<sup>132</sup> are green, underscoring the urgency to scale efforts.

### Accelerate skilling and reskilling through large-scale programmes and support entrepreneur-led models through funding and incubation:

- Rapid economic shifts are demanding urgent reskilling to prevent job losses and social inequities. India, for example, is projected to lose 34 million full-time jobs by 2030<sup>133</sup> due to heat stress, making it the country with the highest absolute job loss globally. Structured programmes (new as well as refresher trainings) for mid-career professionals and informal workers can help them transition to green roles without income disruption. Using Industrial Training Institutes (ITIs) and

digital platforms for modular courses will make learning more accessible and scalable. At the same time, entrepreneurship is emerging as a key driver of green growth. Promoting climate-positive business models can generate local employment and foster innovation. With India's green economy projected to unlock US\$1 trillion in value by 2030 and US\$15 trillion by 2070<sup>134</sup>, entrepreneurship will be central to realizing this potential.

### Strengthen labour market intelligence and expand partnerships to co-create curricula and certification standards:

- Reliable labor market intelligence will help policymakers and industry anticipate skill shortages and design responsive interventions. Dynamic dashboards and real-time analytics can inform curriculum updates, funding priorities, and regional skilling strategies. Meanwhile, collaborative models between industry, academia and government can accelerate the adoption of green skills. Initiatives like the Skill Council for Green Jobs should

be scaled to ensure training remains relevant and globally benchmarked. Partnerships with training and academic institutions can help bridge skill gaps. For instance, institutes like IIT Roorkee<sup>135</sup> and other leading universities have introduced integrated certificate courses on sustainability, ESG, and related standards to help professionals stay competitive in the market.

“The returns on investing in people to drive energy efficiency are remarkable. It builds internal capabilities and a culture of ownership. The payoff is two-fold: immediate with cost savings and ongoing in building long-term resilience”

**Nadir Godrej**

**Chairman and Managing Director, Godrej Industries Group**

A circular economy enterprise that collaborates with companies and urban local bodies to deliver decentralised, end-to-end waste management solutions.

# Conclusion

The climate landscape is evolving rapidly, demanding responses that go far beyond business as usual. The risks are intensifying, the pathways are complex, and yet this moment offers an unprecedented opportunity to redefine India's model of **resilient growth** – one that aligns environmental stewardship with economic well-being.

Moving towards such climate-resilient growth through a systems-based approach should not be seen as a short-term fix, but rather as a fundamental shift in how India defines growth, equity, and resilience. It will depend on progress across multiple fronts, such as policy and governance, technology and finance, institutions and communities, awareness and behavioural change.

Each of these levers plays a role in shaping a climate-ready future. For instance, coherence in policy across national, state, and local levels ensures that the right policies are aligned and effective at the local level, where climate action has its greatest impact. At the same time, India's strength lies in its ability to design systems that operate at a population scale – combining innovation, inclusion, and efficiency. Applying this approach to climate action through interoperable digital infrastructure, data-driven systems, and AI-enabled solutions can help bridge silos, lower costs, and accelerate coordinated, evidence-based responses across sectors.

Evidence is what transforms climate dialogue into direction. By grounding our efforts in data, we ensure that every step we take leads to measurable change.

**Jalaj Dani**  
Founder Asiana Alternate Investment Fund (AIF)

However, these efforts must converge. Real progress will depend on connecting them into a shared architecture of climate readiness; one that aligns with the country's ambition and help convert intent into competitive advantage. Success will hinge on the ability to move from fragmented projects to integrated systems, and short-term responses to robust institutional mechanisms that can withstand future shocks.

Such an integrated approach also helps reframe what progress itself means. For India, resilient growth will not just be about managing risks or addressing impacts in the aftermath; it will be about redefining development, creating a model that is fair, future-ready, and in harmony with nature. When resilience becomes intrinsic to how a nation builds, produces, and governs, it strengthens competitiveness, as well as safeguards collective well-being. The path ahead may be demanding, but it offers a chance to turn challenge into opportunity – proving that sustainability and prosperity are not opposing pursuits, but the twin foundations of India's next chapter of growth.



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## Our approach

To ensure a rigorous and inclusive assessment of the state of climate and stakeholder response, we employed a multi-pronged approach:

- **Baseline climate assessment:** We used the latest available climate data and analysis to map a baseline across key climate indicators, spanning environmental, social and economic dimensions to ascertain the current state of climate in India. For this purpose, we conducted in-depth literature reviews and engaged with subject matter experts to understand the causal loops, systemic interconnections and potential tipping points across sectors.
- **Climate Connect Workshop, Mumbai, April 2025:** Over 50 participants from government, corporations, nonprofits and civil society attended this convening, facilitating cross-sector collaboration and knowledge-sharing on climate risks, best practices and actionable strategies for transition.
- **One-on-one focus interviews with key stakeholders:** Interviewed corporate leaders to assess climate awareness, readiness and budgets; engaged with foundations, NGOs and civil society to understand strategic priorities, ecosystem roles and successful interventions.
- **Deloitte's Citizen Climate Survey 2025:** Surveyed 1,700+ households across India to capture public perception of climate change, lifestyle shifts for mitigation and adaptation and readiness to act. The survey highlights motivators and barriers to collaboration and reveals socio-demographic and regional divides shaping climate vulnerability and adaptive capacity.
- **Corporate Climate Readiness Survey 2025:** Engaged 50+ corporates across sectors to assess how organisations are preparing for, adapting to, and leading climate-related transitions.
- **Deloitte's 2024 CxO Sustainability Report (India Insights):** Engaged 150+ corporates across sectors to evaluate awareness, preparedness, investments and collaboration needs for climate mitigation. The survey explores business actions, barriers and lessons from industry leaders, while highlighting the enduring strategic importance of sustainability and opportunities for greater organisational impact.

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## List of abbreviations

S. No.	Abbreviation	Description
1.	AAS	Agromet Advisory Services
2.	AMRUT	Atal Mission for Rejuvenation and Urban Transformation
3.	BRSR	Business Responsibility and Sustainability Reporting
4.	CDGWB	Central Groundwater Board
5.	CDP	Carbon Disclosure Project
6.	CEO	Chief Executive Officer
7.	CPCB	Central Pollution Control Board
8.	CSR	Corporate Social Responsibility
9.	CXO	C-suite executive
10.	DST	Department of Science and Technology
11.	EPR	Extended Producer Responsibility
12.	ESG	Environmental, social and governance
13.	EU	European Union
14.	EV	Electric Vehicle
15.	FMCG	Fast Moving Capital Goods
16.	GDP	Gross Domestic Product
17.	GLOF	Glacial Lake Outburst Flood
18.	GP	Gram Panchayat
19.	HAP	Heat Action Plan
20.	IARI	Indian Agricultural Research Institute
21.	ICAR	Indian Council of Agricultural Research
22.	ICIMOD	International Centre for Integrated Mountain Development
23.	ICZMP	Integrated Coastal Zone Management Programme
24.	IMD	India Meteorological Department
25.	INCOIS	Indian National Centre for Ocean Information Services
26.	IRDAI	Insurance Regulatory and Development Authority of India
27.	ISRO	Indian Space Research Organisation
28.	MISHTI	Mangrove Initiative for Shoreline Habitats & Tangible Incomes
29.	MLD	Million Litres per day
30.	MoEFCC	Ministry of Environment, Forest and Climate Change
31.	MoES	Ministry of Earth Sciences
32.	MoHUA	Ministry of Housing and Urban Affairs
33.	MSME	Micro, Small and Medium Enterprises
34.	MSW	Municipal Solid Waste
35.	NAAQS	National Ambient Air Quality Standards
36.	NAPCC	National Action Plan on Climate Change
37.	NBFC	Non-Banking Financial Company (NBFC)
38.	NCAP	National Climate Action Plan

S. No.	Abbreviation	Description
39.	NDMA	National Disaster Management Authority
40.	NGO	Non-Governmental Organisation
41.	NMCG	National Mission for Clean Ganga
42.	NMSA	National Mission for Sustainable Agriculture
43.	ODF	Open Defecation Free
44.	PM	Particulate Matter
45.	PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
46.	RBI	Reserve Bank of India
47.	SBM	Swachh Bharat Mission
48.	SPCB	State Pollution Control Board
49.	SUP	Single Use Plastics
50.	SWMRT	Solid Waste Management Round Table
51.	UHI	Urban Heat Island
52.	ULB	Urban Local Body
53.	UN	United Nations
54.	US\$	US Dollar
55.	VC	Venture Capital
56.	WIHG	Wadia Institute of Himalayan Geology
57.	WOTR	Watershed Organisation Trust
58.	WRI	World Resources Institute

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