



Workshop

Transformative Pathways for Climate Resilient Chhattisgarh

Perspectives and the Way Forward

Chhattisgarh is the state playing a pivotal role in advancing India's climate objectives and sustainable development due to its abundant natural resources and industrial capabilities. Although it ranks among the most climate-vulnerable states, it possesses the potential to bolster the country's energy security through its rich mineral deposits while transitioning industries toward sustainable practices. Chhattisgarh can establish a benchmark for sustainable growth that fosters local development and environmental stewardship, by harnessing these resources for cleaner production and adopting best practices from successful models. The state can strategically promote renewable energy, decarbonization, circular economy initiatives, and sustainable transportation, positioning itself as a key player in India's energy transition and a model for sustainable development.

(I) Current Climate Status in the State

Chhattisgarh's tropical climate features hot, humid summers (April–June) with temperatures from 30°C to 47°C, and mild winters (5°C to 25°C). While extremes range from below 0°C to 49°C, minimum temperature data from 1990 to 2023 shows a stable trend, averaging around 32°C, peaking at 33.1°C in 2009, and dipping to 31.5°C in 2020 (Figure 2). In contrast, annual precipitation varies more widely, from 968.6 mm in 2000 to 1803.9 mm in 1994 (Figure 2), though the state averages 1,250 mm annually, with 90% during the monsoon (June–September). Such precipitation variability, along with stable minimum temperatures, highlights climate resilience challenges, as fluctuating rainfall impacts water availability and agriculture, emphasizing the need for adaptive resource management.

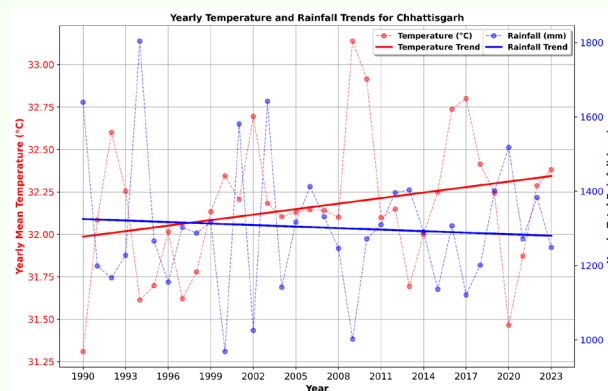


Figure 1: Yearly Temperature and Rainfall Trends for Chhattisgarh

Dry and wet conditions in Chhattisgarh

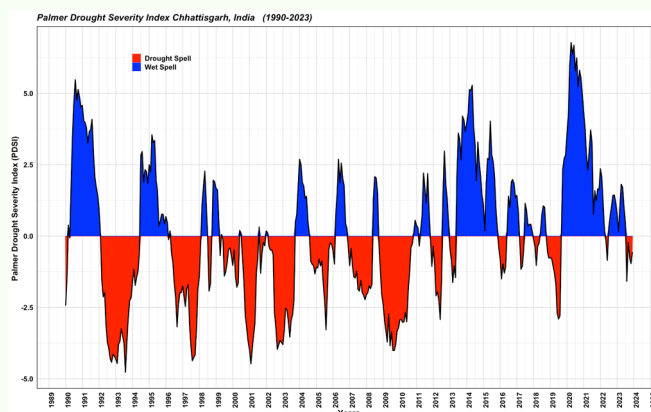


Figure 2: Graph Showing Dry and Wet conditions in Chhattisgarh

Climate Impacts Demand for Resilience Measures

Chhattisgarh faces significant climate challenges that impact its environmental and economic stability. A major environmental challenge is that about 17.06% of its land is classified as degraded, reflecting a 0.70% increase from 2011-13 to 2018-19.

Chhattisgarh's economy heavily relies on rain-fed agriculture, with approximately 80% of the rural population engaged in farming. Recent trends show a decrease in average rainfall—from 1,400-1,600 mm to around 1,200-1,400 mm—and a reduction in monsoon duration from 80-90 days to just 65 days. These changes have led to more frequent and intense droughts, significantly impacting crop yields and threatening food security. Furthermore, many farmers lack access to effective adaptation strategies and resources, such as timely weather forecasts and climate-smart agricultural practices.

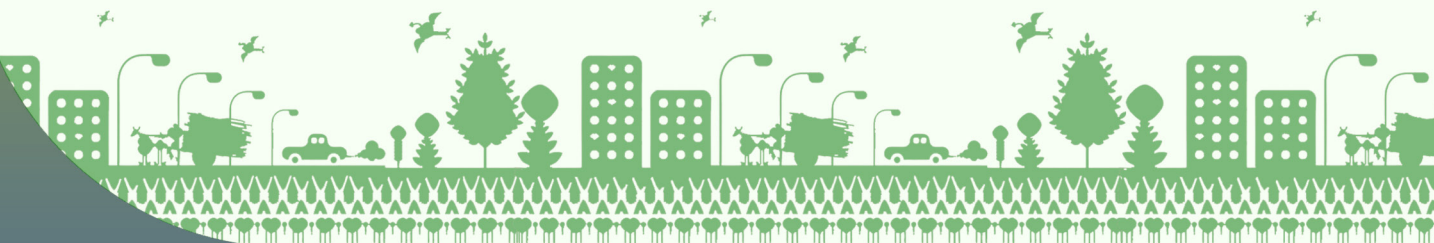
The updated SAPCC-2024 builds upon the initial NAPCC (National Action Plan on Climate Change) framework established in 2014, aiming for “Inclusive Growth for Improved Resilience.” It identifies 247 actions across eight thematic areas.

Mineral Wealth in Chhattisgarh and the Need for Decarbonisation

The state's rich mineral deposits, including substantial reserves of bauxite, coal, iron ore, and tin concentrates make it a crucial hub for mining and industrial activities in India. Chhattisgarh is a major producer of iron ore and limestone, accounting for approximately 18% of India's iron ore and 11% of dolomite resources, but it grapples with pollution and ecosystem degradation. The state has seen a significant rise in CO₂ emissions, increasing by nearly 210% from 2000 to 2022, with 255 million tonnes of CO₂ equivalent emissions recorded in 2022, primarily driven by the coal and mineral extraction sectors. Despite its industrial base, Chhattisgarh faces substantial challenges due to climate vulnerability. Greenhouse gas emissions surged by 210.9%, adding 173.58 million tons with an annual growth rate of 9.59%, predominantly driven by the energy sector, which contributes 76% of total emissions. Agriculture follows with an 18% contribution, while waste and transport have minimal impact. These challenges necessitate urgent measures for decarbonization to achieve environmental sustainability and climate resilience.

(II) Climate Vulnerability to Resilience in Eastern States

Chhattisgarh, along with its neighboring eastern states—Jharkhand, Odisha, and West Bengal—plays a pivotal role in supporting India's energy security and driving economic growth. However, the region faces substantial climate-related risks, with Chhattisgarh itself ranking 4th in India's climate vulnerability index at 0.623. This level of vulnerability places Chhattisgarh just behind Jharkhand, which has the highest index at 0.674, and Odisha, ranked 3rd with an index of 0.633, while West Bengal follows at 8th with an index of 0.592 (as illustrated in Figure 3). The challenges posed by these vulnerabilities underscore the urgent need for targeted climate resilience efforts in Chhattisgarh, both to safeguard its economic contributions and to protect its communities from escalating environmental risks.



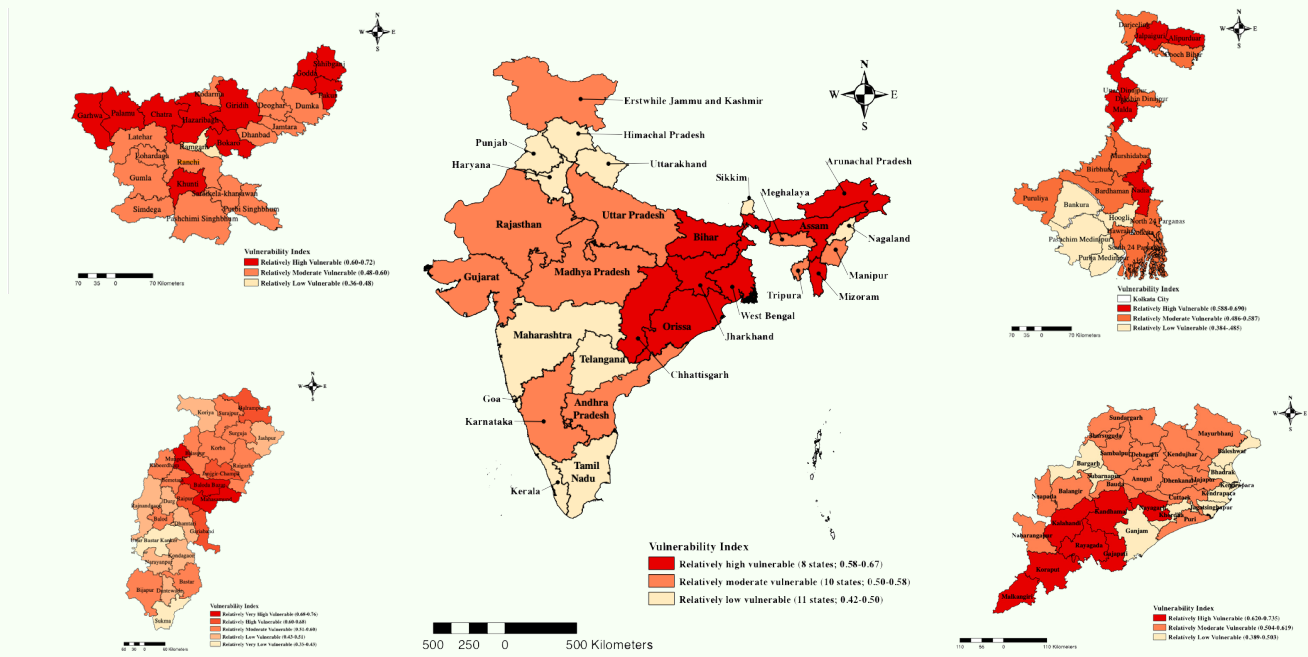


Figure 3: Climate Vulnerability of Jharkhand, Chhattisgarh, Odisha and West Bengal

Source: DST (2021)

Due to its geographic and climatic diversity, Chhattisgarh faces distinct environmental challenges alongside Jharkhand, Odisha, and West Bengal. Rising temperatures, erratic rainfall, and frequent droughts are worsening vulnerabilities, particularly in agriculture-dependent regions within the state.

While Odisha and West Bengal contend with coastal cyclones and floods, Chhattisgarh grapples with deforestation, land degradation, and water scarcity, which intensify the impacts of climate change. Over the past three decades, Chhattisgarh has seen a steady increase in its yearly mean temperatures, with averages nearing 32°C, leading to more intense heat conditions (as shown in Figure 4). Adding to this challenge is the growing frequency of heatwaves, with Chhattisgarh bearing the brunt, recording an alarming 1,077 heatwave events between 1990 and 2023. Although Jharkhand and West Bengal experience fewer heatwave occurrences, Chhattisgarh's escalating climate risks are especially pronounced, creating substantial challenges for local communities and ecosystems.

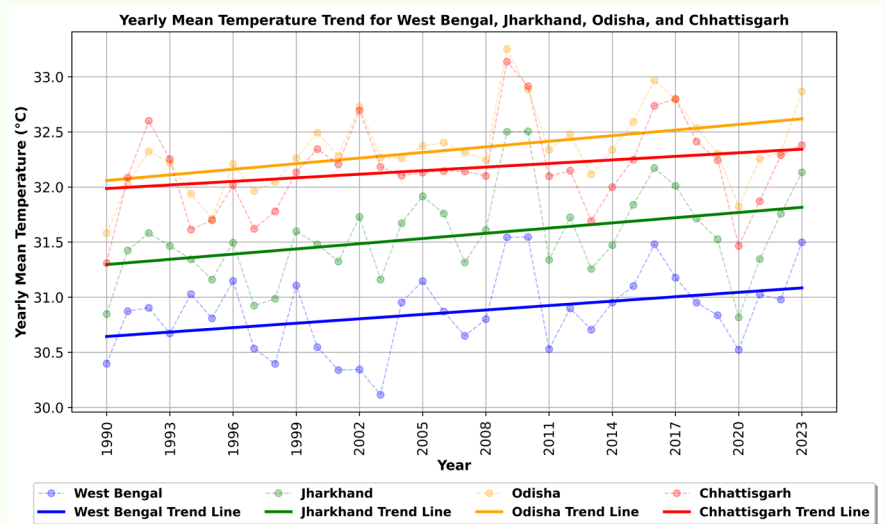


Figure 4: Yearly Mean Temperature for four states

State	2018-19 (%)	Ranking
Jharkhand	68.77	1
Odisha	34.42	12
West Bengal	20.1	17
Chhattisgarh	17.06	18

Table 1: Desertification and Land Degradation State Rankings

Desertification and land degradation in 2018-19 reveal significant disparities across states, with Chhattisgarh experiencing 17.06% of its land affected by degradation, ranking it 18th nationwide. While this percentage indicates a relatively lower level of degradation compared to states like Jharkhand, where 68.77% of land is degraded (ranking 1st), Chhattisgarh still faces challenges that warrant targeted action. Neighboring Odisha, ranked 12th with 34.42% affected land, and West Bengal, ranked 17th with 20.1%, reflect varied degradation levels across the region. These insights emphasize the need for Chhattisgarh to adopt tailored strategies to address its specific challenges in combating desertification and land degradation, as detailed in Table 1 and illustrated in Figure 5.

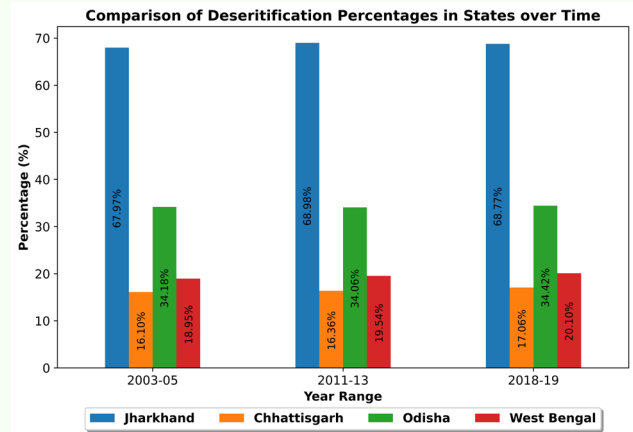


Figure 5: Desertification and Land Degradation Status of states over the time

Source: SAC 2020-21

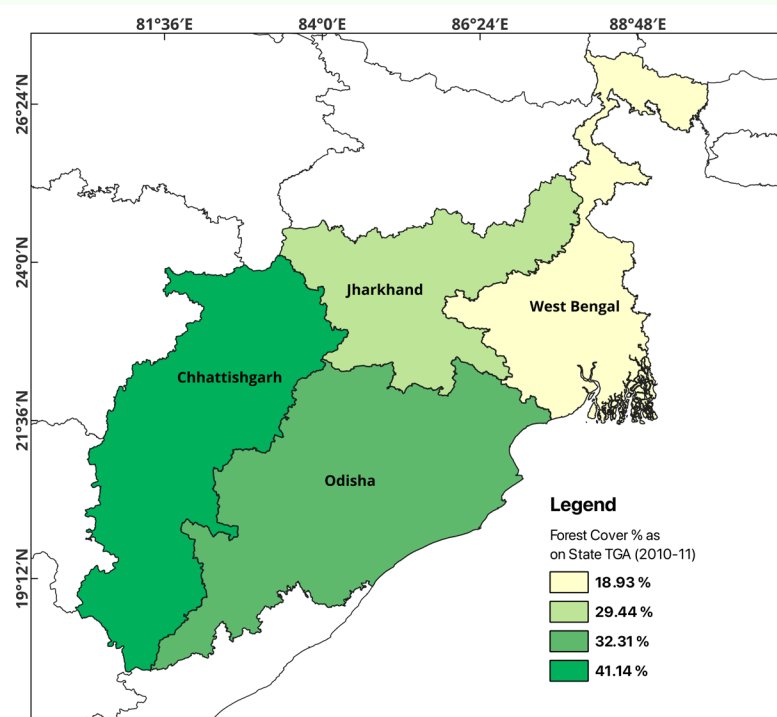
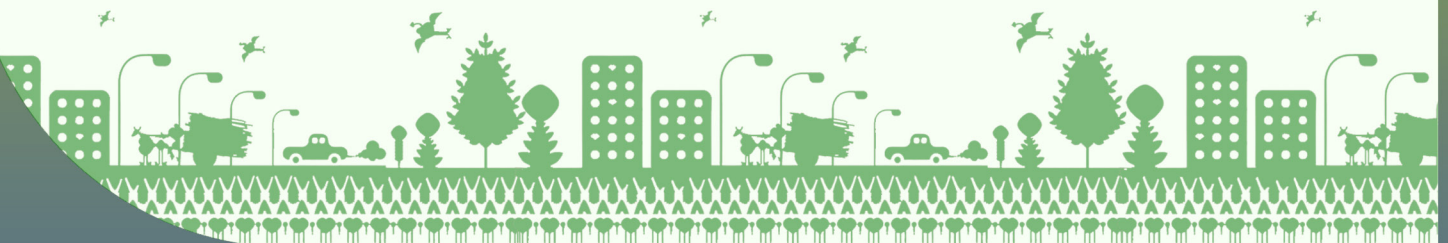


Figure 6: Forest Cover Area for Four States (2019-20)

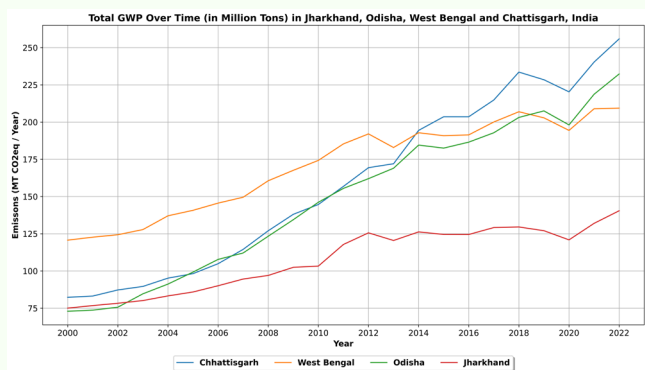
Source: FSI

Between 2010-11 and 2019-20, Chhattisgarh maintained the highest forest cover among neighboring states, with a stable coverage moving slightly from 41.14% to 41.13%. This stability reflects Chhattisgarh's ongoing efforts in preserving its forested regions despite environmental pressures. Odisha experienced a modest increase from 32.31% to 33.12%, while Jharkhand's cover rose from 29.44% to 29.61%. West Bengal, with the lowest initial forest cover, saw a slight improvement from 18.93% to 19.04%. Although these changes across states were minimal, they signal steady progress in maintaining and enhancing forested areas (see Figure 6).

Given the climate-related challenges, Chhattisgarh must prioritize climate-resilient infrastructure and sustainable resource management. Strengthening initiatives for water conservation, improved land-use practices, and increased afforestation will be vital to mitigating climate impacts and fostering ecological and economic resilience in the state.



Industries in Chhattisgarh, along with those in Jharkhand, Odisha, and West Bengal, particularly in sectors like steel, cement, and power generation, are major contributors to India's CO₂ emissions. Chhattisgarh's reliance on coal for high-temperature industrial processes, such as in steel and cement production, results in significant emissions that impact air quality and public health. The state faces the dual challenge of meeting rising industrial demands while managing the environmental consequences of CO₂, particulate matter, sulfur dioxide, nitrogen oxides, and carbon monoxide emissions.



Decarbonizing these energy-intensive sectors is essential for both large-scale industries and the MSME sector, which is vital to Chhattisgarh's economy yet remains reliant on traditional energy sources. Moving towards cleaner energy solutions, such as electrified heat systems, zero-carbon hydrogen, enhanced energy efficiency, and carbon capture and storage technologies, will be crucial for reducing emissions in the state.

Over the past two decades, CO₂ emissions have escalated, with Chhattisgarh leading the region at 256 million tonnes of CO₂eq in 2022. Key industrial belts in Chhattisgarh have emerged as greenhouse gas hotspots, driven by heavy industries and coal-based power plants, as illustrated in Figure 7 and Table 1. These industrial zones, dominated by steel and power industries, represent critical areas for focused decarbonization efforts, as highlighted in Figure 6.

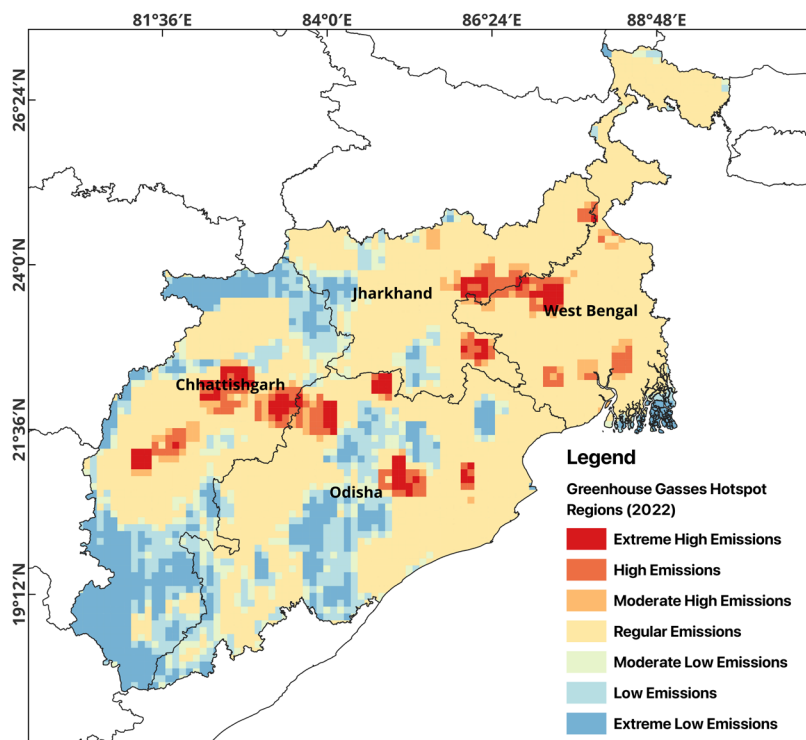
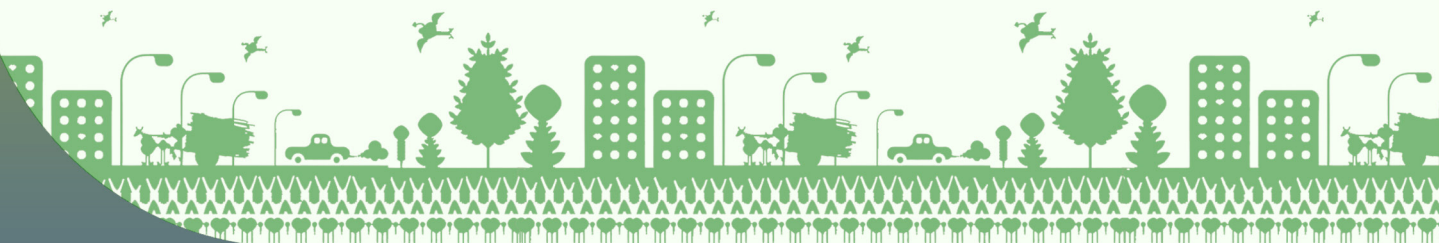
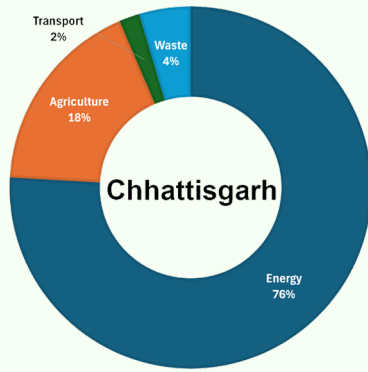


Figure 7: Greenhouse emissions in the states from 2000 to 2022.

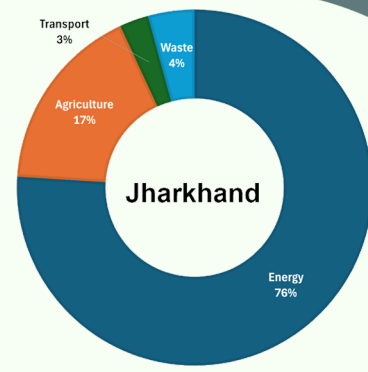
Source: EDGAR V8.0(2022)





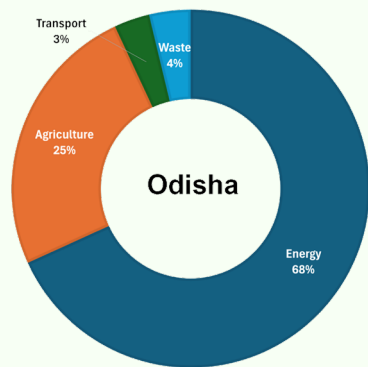
Energy dominates with **76%** of emissions.

Agriculture contributes **18%**, with minimal impact from waste and transport.



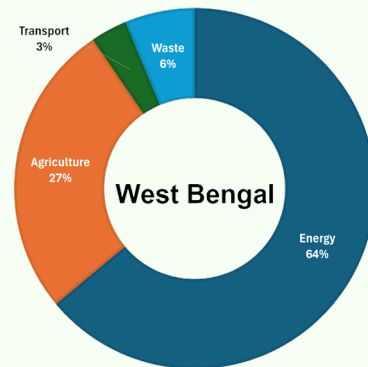
76% of emissions come from the energy sector.

Agriculture accounts for **17%**, with small contributions from waste and transport.



Energy contributes **68%**, slightly lower than other states.

Agriculture has a higher share at **25%**.



Energy contributes **64%**, the lowest among these states.

Agriculture is the highest at **27%**, with **6%** from waste.

Figure 8: Greenhouse gas emissions hotspot regions in Jharkhand, West Bengal, Odisha, and Chhattisgarh (2022)

Source: EDGAR V8.0 (2022)

Key Facts and Figures

- Jharkhand has 68.77% of its land degraded, the highest among these states.
- Odisha's land degradation is 34.42%, up by 0.36% since 2011-13.
- West Bengal has 20.1% of its land degraded, a 0.56% rise from 2011-13.
- Chhattisgarh's degradation is at 17.06%, increasing by 0.70% since 2011-13.
- Water erosion impacts 49.12% of Jharkhand's land, the highest among the four.
- Chhattisgarh's mining for iron ore and limestone significantly harms ecosystems.
- Chhattisgarh's emissions surged by 210.9%, adding 173.58 million tons with a 9.59% annual growth.
- West Bengal's emissions grew by 73.5%, totaling 88.69 million tons with a 3.34% annual increase.
- Jharkhand leads in climate vulnerability (0.674), followed by Odisha (0.633), Chhattisgarh (0.623), and West Bengal (0.592).
- Odisha's emissions rose by 218.4%, reaching 159.36 million tons annually.
- MSMEs in steel and cement add significantly to regional emissions and air pollution.
- Particulate emissions from these states worsen public health and air quality.
- Clean energy transition is vital for decarbonization and achieving India's 2070 net-zero target.
- Agriculture contributes 17-27% of emissions, with a higher share in Jharkhand and West Bengal.
- Large steel plants in Odisha are major contributors to greenhouse gas emissions.

(III) Transformative climate strategies for a resilient future

Eastern India faces significant and complex climate challenges. States like Jharkhand, Chhattisgarh, Odisha, and West Bengal are particularly vulnerable, grappling with extreme weather events such as cyclones, heatwaves, and erratic rainfall. In response, these states have embraced transformative strategies to not only combat climate impacts but also build resilience and safeguard livelihoods. Their approach blends strong policy frameworks, community-centered adaptation efforts, sustainable resource management, and innovative technologies to tackle the unique challenges posed by climate change.

Policy-Driven Climate Action Plans

Addressing the multifaceted nature of climate change requires more than just one-size-fits-all solutions. It calls for a multidimensional approach to policy-making to ensure that climate action is both effective and equitable. India's states are leading the charge, with their **State Action Plans on Climate Change (SAPCC)** serving as a guiding framework. These states are implementing tailored policy solutions, from promoting electric vehicles and solar energy to advancing sustainable resource management, all aimed at mitigating the risks of climate change. Chhattisgarh, launched an updated SAPCC this year with a stronger, more comprehensive approach to tackling climate challenges.

Renewable Energy and Green Infrastructure

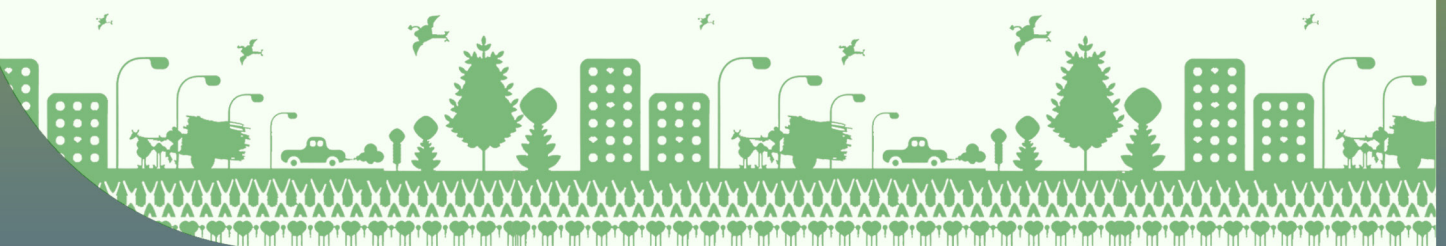
The eastern states, historically dependent on coal, are now shifting toward renewable energy. All of these states have introduced solar energy policies to boost their renewable energy capacity—Jharkhand's State Solar Policy, Odisha's Renewable Energy Policy, West Bengal's Co-generation Policy, and Chhattisgarh's Solar Energy Policy. Chhattisgarh, in particular, has made strides in solar and hydroelectric power, setting up India's largest solar plant with a 100 MW capacity. Additionally, the region is investing in green infrastructure projects. For example, West Bengal's **Green City Mission** focuses on creating sustainable, livable cities, while **Chhattisgarh's Oxy-Van initiative** is turning Raipur into an urban forest to improve air quality and provide green spaces for residents.

Industrial Decarbonization

In eastern India, industries such as mining, steel, and cement contribute significantly to both economic growth and carbon emissions. To address this, the government has introduced initiatives like the **PAT (Perform, Achieve, and Trade) scheme** and the **Carbon Credit Trading Scheme (CCTS)**. These programs incentivize the steel industry to reduce energy consumption and lower emissions through a carbon credit trading system. These states are also exploring breakthrough technologies, including green hydrogen production, carbon capture and storage, and coal gasification, to further reduce industrial carbon footprints.

Community Resilience and Disaster Preparedness

The threat of extreme weather events is ever-present in eastern India, making disaster preparedness a priority. States like Odisha have led the way with early warning systems, cyclone shelters, and community-based disaster training. West Bengal is working on reinforcing embankments and restoring mangroves to combat flooding, while Jharkhand and Chhattisgarh are focusing on water conservation projects, such as check dams, and promoting drought-resistant crops. At the heart of these efforts is the empowerment of communities to actively participate in climate adaptation and mitigation.



Sustainable Agriculture and Resource Management

Agriculture and forests are vital to the livelihoods and development of the eastern states. Promoting sustainable agriculture is key to ensuring long-term resilience. Initiatives like the **Paramparagat Krishi Vikas Yojana** in Jharkhand aim to boost soil fertility through organic farming. Odisha's **Community Tank Development and Management Society (OCTDMS)** works to restore minor irrigation systems, helping farmers build self-sustaining water management practices. These community-driven efforts are crucial for the future of agriculture in the region.

Community-Centric Approaches and Capacity Building

Empowering local communities is central to building climate resilience in eastern India. Programs like "Suryamitra," which trains individuals in solar energy deployment, help foster both employment and sustainable energy practices. By providing communities with the skills and resources needed to adapt to climate change, these initiatives create long-lasting change and strengthen local resilience. **Jharkhand Climate Resilience Information System and Planning (JHAR-CRISP)** is developed to help rural communities deal with climate change as the state increasingly experiences more frequent and intense droughts and associated water stress.

Financing Climate Efforts

Financial support is crucial for the success of climate adaptation and mitigation efforts. Odisha has become a pioneer in this area, becoming the first state to receive **Green Climate Fund (GCF)** financing for a project focused on groundwater recharge and solar micro-irrigation. Additionally, Odisha's **Climate Change Budget Coding** initiative tracks climate-related expenditures, ensuring that resources are allocated effectively for long-term climate resilience. Chhattisgarh government has also mentioned climate budget tagging/coding (CBT) as one the way as a measure to mainstream climate actions instate budget. States are utilizing finance mechanisms like **National Adaptation Fund for Climate Change** at national level, and other innovative financing mechanisms like **Green Bonds** and **Weather derivatives**.

Chhattisgarh plays a crucial role in India's energy sector, but it also faces serious climate challenges that put its communities and economy at risk. As one of the most climate-vulnerable states in the country, Chhattisgarh must take proactive steps to build resilience. The state is already grappling with rising temperatures, land degradation, and water scarcity, making it essential to focus on sustainable resource management, water conservation, and strengthening its forest cover. At the same time, Chhattisgarh's industrial sector, which contributes heavily to emissions, needs to embrace cleaner energy and decarbonization solutions. With a stronger focus on renewable energy, disaster preparedness, and community-based adaptation, Chhattisgarh has the potential to turn these challenges into opportunities, building a more resilient and sustainable future for its people and the environment.

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