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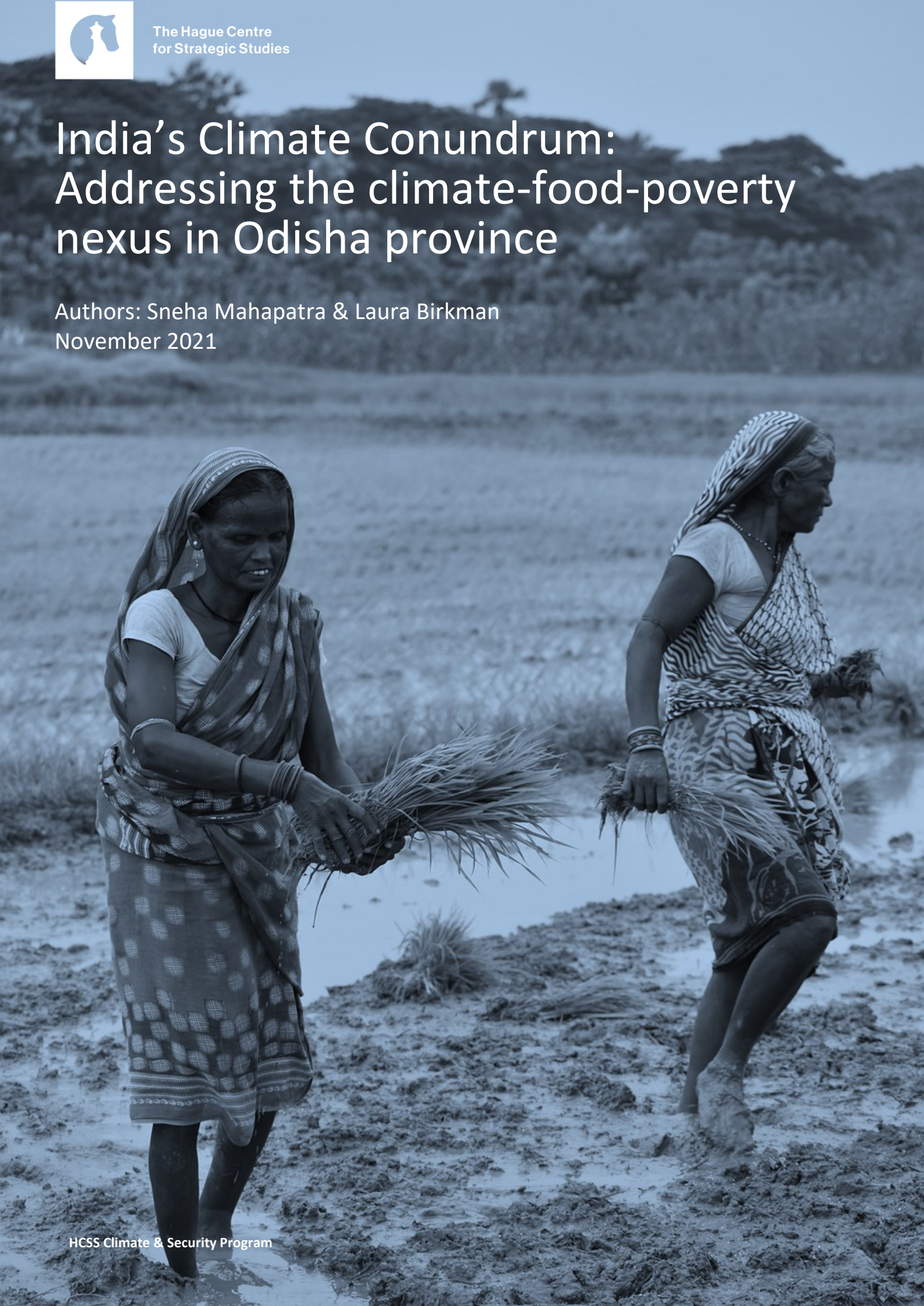
Authors: Sneha Mahapatra & Laura Birkman
November 2021



HCSS Climate & Security Program

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India is considered one of the most exposed and vulnerable countries to climate change and its devastating impacts in the world. Extreme heatwaves, drought, tropical cyclones, floods, irregular rainfall, and shifting monsoon patterns are all packed into a hazard mix that could lead India to deal with a myriad of social, political, economic and security challenges for many generations to come. In order to prevent, mitigate, and respond to climate change, India must come to better grips with the actions it can and should take at regional and district level. Early warning and early action will be essential. Odisha province – one of India's poorest and most agriculture-dependent regions hit the hardest by climate change – is a case in point. This brief explains how the climate-food-poverty nexus in Odisha may be better managed to build resilience and avert disaster.

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India's Climate Conundrum

"India is not Delhi or Bombay, the soul of India lives in its villages!" Mohandas Karamchand Gandhi exclaimed at the beginning of the 20th century. **Gandhi believed firmly that self-reliant villages form a sound basis for a just, equitable and non-violent order and this must be the guiding principle for all its citizens, constructive workers and policy makers.[1] Today, Gandhi's words may prove even more meaningful as India is forced to tackle its greatest 21st century challenge: climate change.**

From wildfires caused by extreme heat and moisture loss, to devastating floods following extreme rain events, and tropical cyclones resulting from the changing temperatures between the sea and land surface - India is one of the countries most affected by climate change in the world. As India's climate change continues unhindered, provinces in east and northeast India[2] are expected to reach extreme temperatures of 48-51°C as of 2030, with Titilagarh in Odisha province already reaching 48.5°C in 2016.[3]

As of 2021, climate models indicate that the average share of work hours[4] lost on an annual basis in India due to extreme heat and humidity is roughly 15%. By 2030 that could further increase upto 30%, the equivalent of an additional three and a half weeks of lost daylight working hours per year. Specifically, the areas in the northwest and on the east coast (where hot continental air mixes with humid ocean currents) will experience larger share of work hours lost than the less-humid interior (see Figure 1).[5]

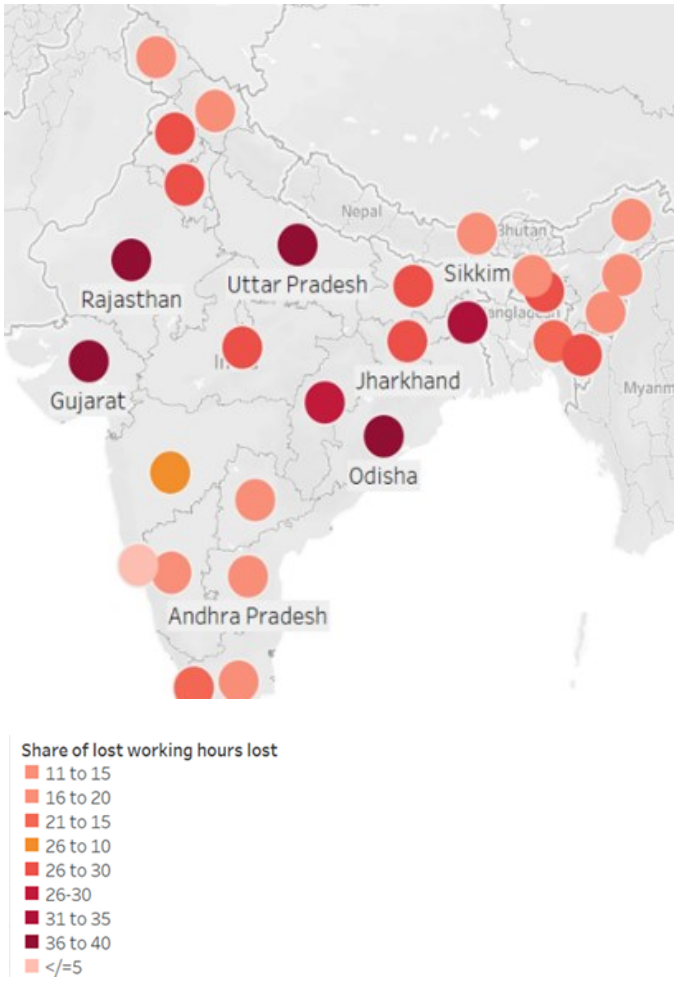

Figure 1: Intensity of extreme heat and humidity is projected to increase, leading to a higher expected share of lost working hours in India |Source: Woodwell Climate Research Centre, 2021.

1 Joshi, "Gandhiji on Villages."
2 States in Eastern include: Bihar, Jharkhand, Odisha and West Bengal and in and North Eastern India include: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, respectively.
3 Reporter, "Titlagarh Breaks All-Time Heat Record for April Month."
4 Working hours lost due to extreme heat generally fall between 11am to 4pm.
5 Woetzel et al., "Will Climate Change Mean India Will Get Too Hot to Work?"

Agriculture is the source of income of nearly 58% of the country, making household incomes extremely vulnerable to the effects of climate change. Based on a geospatial, district-by-district analysis of exposed GDP and a projection of lost working hours, [due to] increasing heat and humidity could put approximately 2.5–4.5% of India's GDP (or, roughly US$150–250 billion) at risk by 2030.[6] As the physical impacts of climate change continue to augment, not integrating climate resilient methods into agriculture will cause acute economic disruption in India, with the effects continuing to grow over time (see Figure 2).[7]

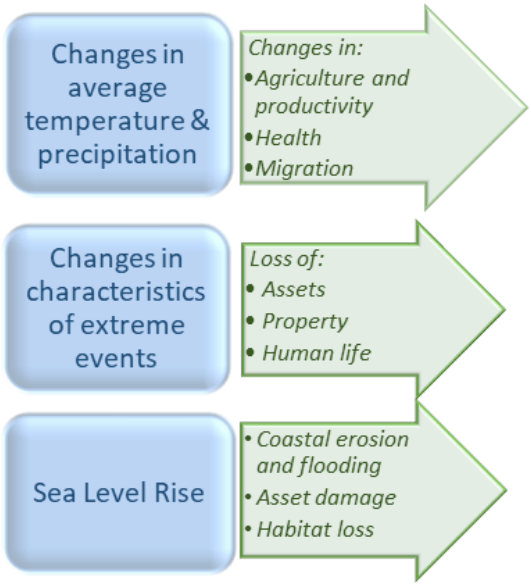

Figure 2: Socio-economic impacts of climate change in India| Source: Own elaboration from IPCC, UNFCC and FAO reports.

1.1. Importance of context: The sub-national imperative

India's climate consists of a wide range of weather conditions across a vast geographic scale and varied topography, making any generalizations about the impact of climate change on the subcontinent very difficult.[8] However, in India, little to no attention is given to address climate-related security challenges at the provincial level. Most national level State Action Plans for Climate Change (SAPCCs) suffer from the following shortcomings: (1) they are too broad and abstract; (2) they remain largely restricted to state jurisdiction without a clear vision of the responsibilities of India's de-centralised governance systems – including districts and cities, which are still largely neglected areas for climate action; (3) they function as stand-alone documents with limited recognition of the activities of other ministries; and (4) they are focused on technical aspects of climate change rather than community-level deliberations that allow states to draw on local understandings of sustainability to address emerging climate change threats.[9]

6 Woetzel et al.
7 "UNFCC. Climate change: impacts, vulnerabilities and adaptation in developing countries and FAO. "The Impact of Disasters and Crises on Agriculture and Food Security. "
8 "World Maps of Köppen-Geiger Climate Classification."
9 Chaturvedi, Rattani, and Kirtiman, "State Action Plans on Climate Change Need Upscaling and Capacity Enhancement."

Future links between sustainable development and climate change will need to recognize that climate change is context-specific and therefore requires local level action. For example, the coastal areas of the country are threatened by a rise in sea levels with provinces like Odisha, Jharkhand, Bihar, West Bengal and coastal Tamil Nadu needing critical focus on developing climate resilient water management infrastructure to support at-risk farming communities from threats to their livelihood.[10]

This demonstrates that there is a need to drill down to the provincial level to address climate change-related physical impacts. Governance mechanisms need to be improved so that local and provincial level authorities, universities, and civil society organizations can work better together to better prepare for, mitigate, and even prevent region-specific climate-related food security risks, increase local level awareness and understanding, and support the development of longer term climate-resilient strategies.[11]

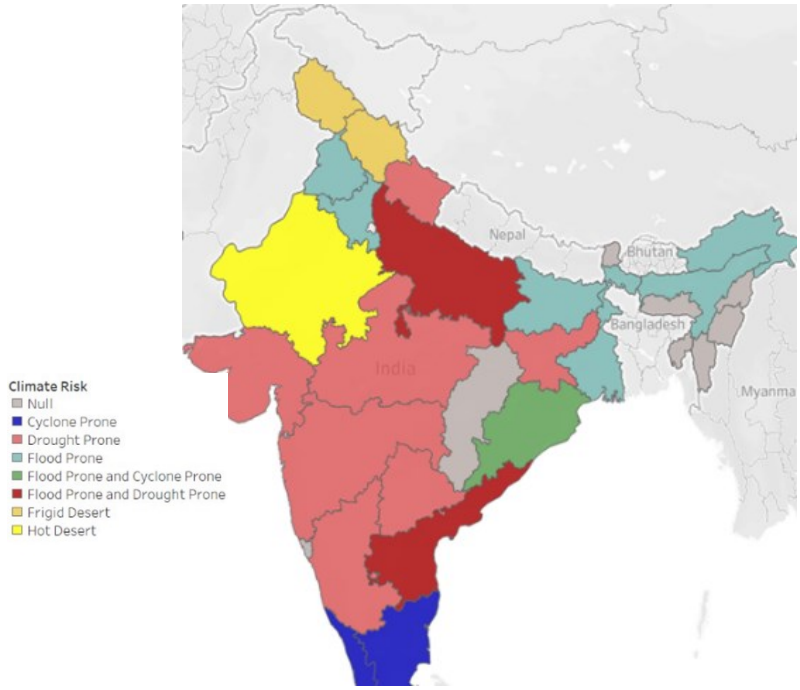

Figure 3: Map of India with Regional Climate Vulnerabilities |Source: Saravask, based on map work by Planemad and Nichalp.

As can be seen in Figure 3, the eastern and northeastern regions of India are found to have a higher vulnerability to climate hazards than the rest of the country[12], being prone to drought, floods and cyclones.[13] Provinces with relatively high climate risk vulnerability are mostly poor with a low per capita income and Human Development Index, indicating a low overall adaptive capacity. The high percentage of the BPL (below poverty line) population, prevalence of rainfed agriculture, a lack of crop insurance, insufficient access to essential services, (including knowledge, technology and insecure tenure) and environmental vulnerabilities including water scarcity, land degradation, threats to biodiversity and being increasingly prone to climate shocks, further compounds agriculture related risks for the likes of provinces such as Odisha.[14]

10 UNDP, "Climate Change Adaptation Activities in India Part I."
11 Dubash and Jogesh, "From Margins to Mainstream?"
12 Desk, "Climate Change to Have Most Affect in 100 Districts of THESE States in India."
13 During summer, the Bay of Bengal is subject to intense heating, giving rise to humid and unstable air masses that morph into cyclones in the exposed coastal states of West Bengal, Odisha, Andhra Pradesh, and Tamil Nadu.
14 Sharma, "Bengal, Odisha, Six Other Eastern States Highly Vulnerable to Climate Change" and; Philip and Rayhan, "Vulnerability and Poverty: What Are the Causes and How Are They Related."

1.2. The climate-food-poverty nexus in Odisha

Odisha – a province in Eastern India– is the 11th most populous province in the country and home to 42 million people. Though poverty reduced sharply after 2005, the province has 14 million poor people with large regional disparities. Of the total number of districts in the state, i.e., 30, 26 districts- home to nearly 36 million people are exposed to extreme climate events such as cyclones, floods, and droughts with negative impacts on their livelihoods.[15] Food security is also threatened in different parts of the province due to climate change induced disasters, disproportionately affecting women as they are typically smallholder farmers.[16]

Figure 4: Erratic rainfall patterns in Odisha leading to increase in floods and droughts| Source: Meteorological Sub-division Wise Annual Rainfall, 2021.

Major climate-related risks

The geographic location of Odisha on the India's east coast and its climatic condition has meant that the state has historically been highly prone to climate change and multiple hazards, mainly cyclones, droughts, heatwaves and floods. Moreover, its fluctuating weather conditions marked by changes in patterns of rainfall (see Figure 4) suggest that Odisha is stumbling under climatic chaos. The state has been declared disaster-affected for 95 years of the last 105 years: floods have occurred for 50 years, droughts for 32 years, and cyclones have struck the state for 11 years.[17] In 2021, 22 districts were rainfall deficient resulting in Odisha overall being a rainfall deficient state (see Figure 5), negatively affecting the *kharif* crop[18] season.[19]

15 "26 Districts in Odisha Vulnerable to Extreme Climate Events."
16 "Household Drought Coping, Food Insecurity and Women in Odisha."
17 Kishor Patel, "Climate Change and Climate-Induced Disasters in Odisha, Eastern India: Impacts, Adaptation and Future Policy Implications | Population Council."
18 The Kharif season varies by crop and region, starting at the earliest in May and ending at the latest in January. In India, the season is popularly considered to start in June and end in October. Kharif crops are usually sown at the beginning of the first rains during the advent of the south-west monsoon season, and they are harvested at the end of monsoon season (October–November).
19 Reporter, "22 Districts in Odisha Record Deficit Rainfall."

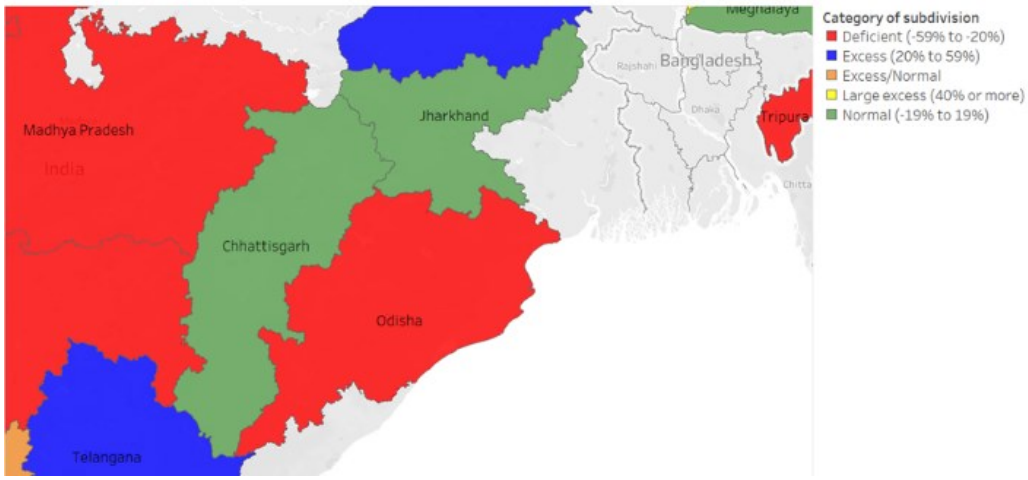

Figure 5: Subdivision Provincial Rainfall Map, showing Odisha is a rainfall deficient state as of 2021| Source: Meteorological Department of India, 2021.

Socio-economic vulnerabilities

Odisha is an agrarian province with almost 70% of its population dependent on agriculture, while contributing only about 26% to the Gross State Domestic Product (GSDP).[20] Moreover, Odisha has 62 different tribal communities who are spatially, socially, economically and politically among the most disadvantaged and secluded groups.

Their strongheld beliefs, unique customs and lack of trust in state officials form the base of the climate security-poverty nexus as well as making it difficult to prioritize a comprehensive climate-secure state agricultural plan.[21]

Relevant elements of the climate-food-poverty nexus

Figure 6 lays out the relevant elements of the climate-food-poverty nexus in Odisha, ranging from the stressors, which drive the nexus, to the coping mechanisms adopted by local communities, their sources of resilience, and the catalysts which further aggravate the nexus.

Stressors. Stressors are factors which contribute to income and agricultural stress by affecting the livelihood of farmers leading to loss of agricultural productivity and increase rates of displacement. **As a coastal state, farmers in Odisha bear the brunt of climate change almost every season, with their livelihoods being constrained by 7-8 months of water stagnation due to floods.**

20 "Agriculture Policy | Directorate of Horticulture."

21 Dungdung and Pattanaik, "Tribal Development Disparities in Odisha."

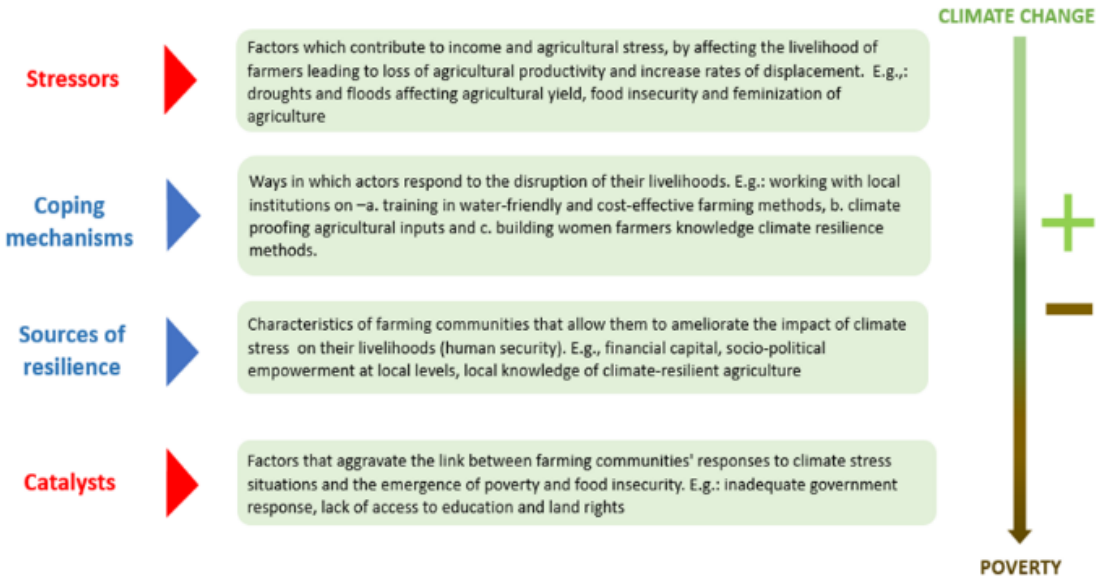

Figure 6: The Odisha Climate-Security-Poverty Nexus| Source: HCSS 2021

With rice, a water dependent crop, as its main staple and being rainfall dependent since the irrigation network does not cover the entire province, the agriculture sector is highly vulnerable to the vagaries of climate-induced weather changes. Rice is highly susceptible to water stress during the reproductive stage, leading to significant reduction in grain. In August 2021, Odisha received only 204.9 mm of rain against a normal of 366.4 mm-- a deficit of 44%. It was in 1998 that the state last witnessed less than 205 mm of rain in the same period. Huge monthly variations in rainfall is taking its toll on paddy yield productivity.[22]

Changing weather patterns marked by irregular rainfall and frequent droughts make agricultural productivity low and reduce the amount of available farm land, as a result of which more people have become landless or migrated to cities in search of work.[23] Men often leave the village to find seasonal work whereas women stay behind, taking on additional agriculture-related activities oftentimes on poor and infertile land, lacking control over it, along with their overfull packet of domestic and care-related tasks. **Climate change deepens existing gender inequality and further perpetuates it because of underlying social barriers that hinders women's ability to access information, relief, technology and the skills to influence climate change policy and actions.[24]**

Coping Mechanisms. Coping mechanisms are defined as the ways in which actors respond to the disruption of their livelihoods. Recognising the availability and social mobilisation potential of women and youth in the coastal areas, organizations such as the Regional Centre for Development Cooperation (RCDC), a local not-for-profit organisation, identifies and works with local resource persons, targeting their training programmes for building leadership and advocacy skills. The training teaches youth how to assess climate change risks, carry out inclusive and gender-responsive community consultations, and facilitates the empowerment of women and most marginalised people in the community. Table 1 highlights the observed outcomes from empowering women as climate action frontline agents.[25]

22 "Excess Rainfall in September Result of Climate Change in Odisha, Say Experts."
23 Sahu, "Sea Erosion Affecting Lives and Livelihoods in Odisha."
24 Pattnaik et al., "The Feminization of Agriculture or the Feminization of Agrarian Distress?"
25 "Gender mainstreaming in the management of the marine and coastal ecosystems. UN environment regional seas."

Political Empowerment	Economic Empowerment	Socio-cultural Empowerment	Physical Empowerment
• Women in Village Committees: decision-making • Women 50% of members of Task Force for Disaster Response • Women climate action ambassadors • Women take active part in dissemination workshops	• Organic gardens production • Income from mangrove saplings • Sale of products of organic gardens • Income from floating gardens • Various training especially for women	• In all project components the work of women was appreciated. • Improved stoves: women asked for their opinions • Women seen as leaders, for example taking active part in sub regional workshops	• Improved health as result of products of organic gardens • Improved cooking stoves: less smoke • Less fuel needed, so less drudgery work of fetching wood • Food products of floating gardens in lean seasons

Table 1:The empowerment approach and resulting improvements |Source: Gender Mainstreaming in The Management of The Marine and Coastal Ecosystems. UN

The Odisha provincial government established the Odisha Organic Mission (OOM) to work with farmers on tackling issues of knowledge dissemination, soil health management, production and supply of quality indigenous seeds, maintenance of biodiversity in crop systems along with provision of adequate agricultural credit, appropriate farm mechanisation, post-harvest management of organic produces and market development. The policy aims at healthier soil along with an eco-friendly approach reducing input costs of farming.[26]

Additionally, in line with the State Agricultural Policy (2013), State Water Policy (2007) and the State Action Plan on Climate Change (2018-2023), the Odisha Integrated Irrigation Project for Climate Resilient Agriculture (OIIPCRA) aims to support the state extension system by providing quality advisory services on Climate-Smart Agriculture (CSA) to a larger number of farmers, along with (a) a seed system, to sustainably deliver good quality, better yielding and resilient germplasm to farmers and (b) a marketing system, to facilitate improved agricultural produce marketing. The Odisha Department of Water Resources has adopted a cascade approach to invest in tank irrigation systems. **From introducing Integrated Water Resources Management in a pilot catchment and incentivizing improved water management and technology adoption by promoting a cost-sharing approach, as well as strengthening, in a more systematic and comprehensive manner, the capacities of *Pani Panchayats*[27] and assessing the sustainability of groundwater use, the approach includes coordination of relevant institutions in the agriculture and water sectors for better and integrated planning.[28]**

Sources of Resilience. Climate change has irrevocably affected the subsistence living of different tribes across Odisha. Heavy rainfall washes away the fertile topsoil from the slopes, disasters such as cyclones adversely affect agricultural productivity through direct damage by high-speed wind, torrential rain and extensive flooding[29], and higher temperatures reduce yields of desirable crops while encouraging weed and pest proliferation.[30]

26 "Organic Farming Policy in Odisha."
27 Pani Panchayat is a voluntary activity of a group of farmers engaged in the collective management (harvesting and distribution) of surface water and groundwater (wells and percolation tanks).
28 World Bank. "Odisha Integrated Irrigation Project for Climate Resilient Agriculture."
29 Rautaray and Panda, "Tropical Cyclone and Crop Management Strategies."
30 Nelson, Rosegrant, et al. "Climate Change."

In areas where tribes are affected by top soil erosion, organizations such as **Watershed Support Services and Activities Network (WASSAN) have worked with tribal communities on issues of awareness creation and promotion of traditional millet farming has led to improved surface soil conservation, by cultivating millets through improved farming techniques to meet climatic challenges.**[31]

Due to regularly occurring droughts and declining rainfall, rice cultivation has seen about a 40% decline in India's eastern states during severe droughts, with an estimated loss of US$ 800 million. Farmers in tribal areas of Odisha have traditionally grown local maize varieties in home gardens for household consumption, selling their remaining surplus in local markets. **Odisha's Department of Agriculture and Cereal Systems Initiative for South Asia (CSISA) has been working on combining local knowledge and promoting uptake of agronomic practices, such as sowing with a seed drill, using multi-crop planters, applying site-specific nutrients, and identifying the best performing maize hybrids has resulted in an increase in farmers revenue and helped them cope with climate-related shocks.**[32]

Other sources of resilience include harmonizing scientific assessments with traditional agro-ecological knowledge to strengthen climate change adaptability and empower distressed small-scale farmers who are most susceptible to threats of climate change.[33] For instance, successful farmers' land being transformed into "field schools" where farmers can get training and exposure to sustainable agricultural methods, such as adopting environmental-friendly seed treatment and consequently increase their productivity.[34]

1.3. Migration, Adaptation, and resilience

Odisha has several prospects to build on adaptative measures that are resilient to climate change risks. Examples include: improved crop and livestock production practices for higher food security and farmer income; utilising the crop suitability approach otherwise known as the agronomic-economic zoning approach to assess the suitability of various lands and biophysical attributes for crop production[35]; safeguarding communities in coastal areas by enhanced early-warning systems, better and water management infrastructure.

Fiscal policies play a vital role in financing resilience building. Odisha's resilience-building must focus on developing a financing road map, and maintain consistent spending over the next decades facilitated by provincial authorities.[36]

Opportunities like using a **public financial management (PFM) tool would help the provincial authorities identify financing gaps, effectively mobilize investment to attain state plans, evaluate the climate financing activities and improve accountability.**[37]

Investing in risk-reduction and adopting other risk-coping strategies such as self-insurance, risk-transfer instruments and ex-ante financing arrangements to yield high returns are other ways Odisha can deal with natural disasters and other climate change shocks. For instance, **the Consultative Group on International Agricultural Research (CGIAR) project which focuses on providing weather-index insurance for small farmers can be a policy instrument taken up by the Odisha state government. The Weather Based Crop Insurance Scheme, WBCIS (area-**

31 Abhijit Mohanty, "In Odisha, an Adivasi Community Is Using Traditional Farming to Fight Climate Change."
32 "Can Maize Help Farmers in Odisha, India, Cope with Climate Change?"
33 Abhijit Mohanty, "In Odisha, an Adivasi Community Is Using Traditional Farming to Fight Climate Change."
34 "Harsha-Trust-Annual-Report-2019-20."
35 Mishra and Sahu, "Economic Impact of Climate Change on Agriculture Sector of Coastal Odisha."
36 Report. "Flooded Future"
37 Report. "Flooded Future"

based rainfall insurance) is another disaster risk management tool where farmers benefits include: higher coverage, lower premium, faster and more frequent compensation payment and more transparency.[38]

Finally, provincial authorities need to work with and create awareness among farmers through Gram Panchayat level Training hubs of climate change adaptation and natural resource management for disaster risk reduction at the field levels.[39]

1.4. Conclusion

As Mahatma Gandhi noted, poverty eradication and sustainable growth cannot be achieved without rural development. Most of India and, by extension, its under-employed and unemployed masses, live in rural areas where they suffer from socio-economic vulnerabilities because of climate change related risks. [40]

Focusing on the provincial level is imperative to such growth. Rural poverty has persisted where policies paid insufficient attention to improving agricultural productivity, especially at a time when climate change is putting disproportionate pressure on livelihoods in remote rural areas where people have the least resilience.

Today, Indian provinces such as Odisha are benefitting from government schemes of rainwater harvesting and the expansion of weather insurance mechanisms, solar energy in farming, and other innovative techniques of inter-cropping and using climate resilient seeds to mitigate the climate sensitive nature of agriculture, However, there remains scope for a more robust and inclusive translation of these efforts into areas of climate security policy, including disaster risk reduction initiatives for most marginalized communities[41] and building an enabling environment to purposefully develop provincial systems and processes that can facilitate long-term resilience to climate change and natural disasters.[42]

38 von Lossow, "Towards a Better Understanding of Climate Security Practices, Planetary Security Initiative" and Shields, "Crop Insurance for Adaptation to Climate Change in India."
39 "Adaptation to Climate Change with a Focus on Rural Areas and India."
40 Food and Agriculture Organization of the United Nations, "Poverty Eradication | Sustainable Development Goals."
41 Jayaram, "PB CS Why It Matters for India."
42 Islam and Kieu, "Tackling Regional Climate Change Impacts and Food Security Issues."

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