



## EXAMINING THE IMPACT OF CLIMATE CHANGE ON THE LIVELIHOOD OF RURAL WOMEN IN ODISHA FOR SUSTAINABLE DEVELOPMENT : A MIXED-METHOD INQUIRY INTO THE CHANGING DYNAMICS OF RURAL WOMEN'S ECONOMIC ROLES AMIDST CLIMATE CHANGE

<b>Dr. Dipti Mayee Sahoo</b>	Associate Professor, Department of Business Administration Trident Academy of Technology, Bhubaneswar.
<b>Dr. Nibedita Nath</b>	Associate Professor, PG Department of Anthropology, Maa Manikeswari University, Bhawanipatna.
<b>Dr. Manosmita Mohapatra</b>	Assistant Professor, PG Department of Sociology, Ravenshaw University, Cuttack.
<b>Dr. Keerti Prajapathi</b>	Senior Manager, OneStage Foundation, New Delhi
<b>Ms. Urmila Sahoo</b>	Research Scholar, PG Department of Sociology, Utkal University.

**ABSTRACT** The present study explores the intersection of climate change and gendered livelihood vulnerabilities among rural women in the climate-sensitive districts of Nuapada and Koraput. The research investigates how recurring climatic stresses such as droughts, irregular rainfall, declining agricultural productivity, and resource scarcity disproportionately affect women's livelihoods, unpaid care work, food security, and socio-economic wellbeing. Adopting a mixed-method research design, the study surveyed 400 households across four blocks- Boden, Komna, Laxmipur, and Lamtaput- along with 60 Focus Group Discussions and consultations with Farmer Producer Organizations to capture both quantitative and qualitative dimensions of vulnerability and adaptation. The study is anchored within the framework of the Sustainable Development Goals, particularly SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 5 (Gender Equality), and SDG 13 (Climate Action). It critically examines the accessibility, implementation, and effectiveness of state government welfare and climate-resilience schemes in addressing the needs of marginalized rural women. Findings indicate a significant transformation in women's economic and social roles, including increased participation in wage labour, self-help groups, and adaptive livelihood practices. However, women continue to face structural barriers such as unequal access to land, credit, technology, healthcare, and decision-making spaces. The study highlights the urgent need for gender-responsive climate adaptation policies that integrate local knowledge, strengthen institutional support, and promote inclusive rural development for vulnerable communities in western and southern Odisha.

**KEYWORDS :** Climate Change, Rural Women, Livelihood, Odisha, SDGs, Mixed-Method, Gender, Adaptation, Nuapada, Koraput

### 1. INTRODUCTION

#### 1.1 Background and Rationale

Climate change has emerged as one of the most significant challenges affecting rural livelihoods, food systems, and social equity across developing economies. Its impacts are particularly severe in agrarian regions where communities rely heavily on natural resources and rain-fed agriculture for survival. In such contexts, environmental disruptions such as droughts, irregular rainfall, soil degradation, floods, and extreme weather events directly influence agricultural productivity, household income, nutrition, and employment opportunities. However, the consequences of climate change are not experienced uniformly. Existing social hierarchies based on gender, class, caste, ethnicity, and land ownership shape differential vulnerabilities, making rural women among the most affected populations. Women's limited access to productive assets, financial resources, education, extension services, and decision-making institutions significantly constrains their adaptive capacities and resilience to climate-induced risks.

Within this broader global context, Odisha represents a critical region for examining the intersection of climate change and gendered livelihood vulnerabilities. Odisha is one of India's most climate-sensitive states, frequently experiencing cyclones, droughts, heat waves, flash floods, and erratic monsoon patterns. These environmental stresses have intensified over the past two decades, disrupting traditional agricultural cycles and increasing livelihood insecurity among rural populations. While coastal districts often receive attention for cyclone-related disasters, the western and southern regions of Odisha face equally severe yet less visible climatic challenges, particularly prolonged droughts, declining soil fertility, and water scarcity. These changes have profound implications for women, who play a central role in agriculture, livestock management, forest-based livelihoods, household food security, and unpaid care work.

The districts of Nuapada and Koraput provide important and contrasting socio-ecological settings for understanding these dynamics. Nuapada, located in western Odisha, is a semi-arid and

drought-prone district characterized by recurrent crop failures, seasonal migration, and chronic poverty. Agriculture in the region is heavily dependent on erratic monsoon rainfall, making rural households highly vulnerable to climatic variability. Women in Nuapada increasingly engage in wage labour, migration-linked survival strategies, and informal economic activities to compensate for declining agricultural income. However, their contributions often remain undervalued and invisible within formal policy frameworks.

In contrast, Koraput, situated in the hilly tribal belt of southern Odisha, is characterized by rain-fed subsistence agriculture, forest dependence, and a predominantly Indigenous population. Despite rich biodiversity and traditional ecological knowledge systems, communities in Koraput face increasing environmental instability due to changing rainfall patterns, deforestation, and declining access to common resources. Tribal women contribute substantially to agriculture, seed preservation, forest produce collection, and local food systems. Yet, they continue to experience structural marginalization through limited access to markets, healthcare, institutional credit, and land ownership rights.

The rationale of this study is grounded in the need to adopt an intersectional and gender-responsive framework for climate research and policy. Existing climate adaptation strategies often remain gender-neutral and fail to recognize women as active economic agents and knowledge holders. Drawing from feminist political ecology and sustainable livelihood frameworks, this study seeks to examine how environmental risks intersect with gender relations, social exclusion, and institutional structures to shape women's livelihood experiences. By focusing on two distinct agro-climatic regions, the research aims to generate comparative insights into women's adaptive practices, vulnerabilities, and resilience mechanisms. The study further evaluates the role of state-led welfare and climate adaptation schemes in addressing grassroots realities, thereby contributing to policy discourse on inclusive and sustainable rural development in climate-vulnerable regions of Odisha.

#### 1.2 Research Gap

Existing literature predominantly treats climate vulnerability and gender as parallel concerns rather than intersecting phenomena. Studies on Odisha have focused on disaster response or agricultural productivity, with limited attention to the evolving economic agency of rural women within climate-stressed households. This study addresses this gap by foregrounding women's own narratives, quantifying livelihood shifts, and critically evaluating the alignment between policy interventions and ground realities.

### 1.3 Significance of the Study

The research contributes to:

- Theoretical understanding of gendered climate vulnerability in semi-arid and tribal contexts
- Empirical evidence on livelihood diversification patterns among rural women
- Policy evaluation of state schemes through a gender-climate lens
- SDG monitoring at the sub-national level with disaggregated data

## 2. Research Objectives

Objective No.	Research Objective	SDG Alignment	Methodological Approach
O1	To assess the perceived and actual impacts of climate variability on rural women's traditional livelihood activities	SDG 13 (Climate Action)	Household surveys, FGDs, climate data analysis
O2	To examine shifts in women's economic roles and labour allocation patterns in response to climate stressors	SDG 5 (Gender Equality), SDG 1 (No Poverty)	Time-use surveys, case studies, FGDs
O3	To evaluate women's access to and utilization of adaptive resources, including credit, technology, and information	SDG 1, SDG 5	Household surveys, FPO interactions
O4	To analyze the effectiveness and gender-responsiveness of state government schemes in climate adaptation	SDG 1, SDG 2, SDG 13	Policy document analysis, beneficiary surveys, FGDs
O5	To identify sustainable livelihood strategies and recommend gender-inclusive policy interventions	All four SDGs	Synthesis of findings, stakeholder consultations

## 3. Theoretical Framework

The study is anchored in three complementary frameworks: Sustainable Livelihood Framework (DFID) - Analyzes how climate shocks affect the five capital assets (human, natural, financial, physical, social) differently for women, shaping their livelihood outcomes and adaptive capacities.

Feminist Political Ecology - Interrogates how gendered power relations mediate access to resources, decision-making, and the distribution of climate risks and benefits within households and communities.

Capabilities Approach (Sen/Nussbaum) - Evaluates whether women possess the substantive freedoms (capabilities) to pursue sustainable livelihoods, moving beyond income metrics to examine agency, choice, and wellbeing.

## 4. Study Area Profile

Parameter	Nuapada District	Koraput District
Blocks Studied	Boden, Komna	Laxmipur, Lamtaput
Agro-climatic Zone	Western Undulating Zone (semi-arid)	Eastern Ghat High Land Zone (sub-humid)
Primary Climate Hazards	Drought, heat waves, delayed monsoon	Flash floods, landslides, erratic rainfall
Predominant Livelihood	Rain-fed agriculture, NTFP collection, wage labour	Shifting cultivation, NTFP, terrace farming
Tribal Population	35.8% (Gond, Saura communities)	50.6% (Kondh, Paroja, Gadaba communities)

Female Work Participation Rate	42.3%	48.7%
Key Vulnerabilities	Water scarcity, migration, food insecurity	Land degradation, displacement, market isolation

## 5. Research Methodology

### 5.1 Research Design

A convergent parallel mixed-method design was adopted, wherein quantitative and qualitative data were collected simultaneously, analyzed independently, and integrated during interpretation to provide a comprehensive understanding.

### 5.2 Sampling Strategy

Component	Nuapada (Boden & Komna)	Koraput (Laxmipur & Lamtaput)	Total
Household Surveys	200	200	400
FPO Engagements	30	30	60
Focus Group Discussions	30	30	60

Household Selection: Multi-stage stratified random sampling-blocks selected purposively for climate vulnerability; villages selected randomly; households selected systematically with female respondent preference (married women aged 18-60 engaged in livelihood activities).

**FGD Composition:** 8-12 participants per group; separate FGDs for women SHG members, male household heads, agricultural labourers, and mixed community groups.

### 5.3 Data Collection Tools

Tool	Purpose	Key Dimensions Captured
Structured Household Questionnaire	Quantitative baseline	Demographics, asset ownership, income sources, climate perceptions, scheme access, time-use
FGD Protocol	Community narratives	Collective memory of climate events, coping mechanisms, gender norms, institutional trust
FPO Interaction Schedule	Institutional assessment	Women's membership, decision-making roles, market linkages, climate-adaptive practices
Key Informant Interviews	Policy perspectives	Block officials, Anganwadi workers, agricultural extension officers
Participatory Rural Appraisal Tools	Contextual mapping	Seasonal calendars, resource maps, mobility diagrams

### 5.4 Data Analysis

- Quantitative: Descriptive statistics, chi-square tests, logistic regression (SPSS 26) to examine associations between climate exposure, livelihood transitions, and scheme uptake
- Qualitative: Thematic analysis using NVivo, with inductive coding of FGD transcripts and field notes
- Integration: Joint display matrices, side-by-side comparisons, and narrative weaving

## 6. Alignment with Sustainable Development Goals

### 6.1 SDG Alignment Matrix

SDG	Target	Study Relevance	Indicators Examined
SDG 1: No Poverty	1.1, 1.2, 1.4, 1.5	Climate-induced income erosion; asset depletion; vulnerability to shocks	Household income changes, asset ownership, poverty line movement, shock exposure
SDG 2: Zero Hunger	2.1, 2.3, 2.4	Food security impacts; women's role in agricultural production; sustainable practices	Food consumption scores, dietary diversity, crop diversification, sustainable agriculture adoption
SDG 5: Gender Equality	5.1, 5.4, 5.5, 5.a	Gendered division of labour; unpaid care burden; decision-making; land rights	Time-use patterns, intra-household decision indices, land/asset ownership by gender
SDG 13: Climate Action	13.1, 13.3, 13.b	Resilience strengthening; capacity building; climate finance access	Adaptation strategies adopted, training participation, scheme awareness and utilization

### 6.2 Justification for SDG Selection

SDG 1 (No Poverty): Climate variability directly threatens the economic foundations of rural households. This study examines whether women, as primary caregivers and secondary earners, experience differentiated poverty impacts and whether social protection schemes mitigate vulnerability.

SDG 2 (Zero Hunger): Women in study districts are custodians of food security through homestead farming, NTFP processing, and food preparation. Climate disruptions to these activities have direct nutritional consequences requiring documentation.

SDG 5 (Gender Equality): Climate stress can both reinforce traditional gender roles (through increased domestic labour) and disrupt them (through forced economic diversification). This duality demands empirical investigation.

SDG 13 (Climate Action): Local adaptation capacity is fundamentally gendered. Examining women's access to climate information, adaptive technologies, and institutional support reveals gaps in India's climate action architecture.

**7. State Government Schemes:**

**7.1 Schemes Examined**

Scheme	Department	Relevance to Study	Gender Component
MGNREGS	Rural Development	Employment guarantee; climate-resilient asset creation	33% women work-days mandated
Odisha Livelihood Mission (OLM)	Mission Shakti	Women SHG promotion; enterprise development	Women-exclusive
Odisha Millet Mission (OMM)	Agriculture	Climate-resilient crop promotion; nutritional security	Farm women as implementers
KALIA Scheme	Agriculture	Farmer income support; crop insurance linkage	Women cultivators eligible
Mo Pokhari	Fisheries	Aquaculture promotion; women's livelihood diversification	Women SHG targeting
State Climate Action Plan	Environment	Adaptation priorities; vulnerable group identification	Gender mainstreaming stated
Biju Swasthya Kalyan Yojana (BSKY)	Health	Health security reducing climate-health expenditure shocks	Universal coverage
MAMATA Scheme	Women & Child Development	Conditional cash transfer for pregnant/lactating women	Women-exclusive

**7.2 Scheme Effectiveness Matrix (Based on Findings)**

Scheme	Awareness (%)	Enrollment (%)	Effective Utilization (%)	Key Barriers Identified
MGNREGS	94.2	78.6	52.3	Delayed payments; work unavailability during peak agricultural stress; low wage rates
OLM/ Mission Shakti	86.4	71.2	63.8	Limited enterprise viability; market access constraints; skill gaps
Odisha Millet Mission	45.7	22.4	18.6	Low awareness; input supply chain issues; lack of procurement linkages
KALIA	72.3	58.4	41.2	Documentation barriers; land title issues for women; delayed transfers

Mo Pokhari	28.6	8.2	5.4	Limited reach; technical skill requirements; water scarcity
BSKY	89.3	82.1	68.7	Procedural complexities; hospital network limitations

**8. Key Findings**

**8.1 Objective-wise Findings Matrix**

Objective	Key Quantitative Findings	Key Qualitative Findings	District Variations
O1: Climate Impacts	78.4% reported reduced agricultural yields (last 5 years); 62.3% experienced water source depletion; 84.6% perceived increased heat stress	Climate events narrated as "turning points"—2018 drought in Nuapada, 2019 floods in Koraput fundamentally altered livelihood calculations	Nuapada: Drought dominant (89%); Koraput: Rainfall variability (76%)
O2: Economic Role Shifts	Women's contribution to household income increased from 28.4% to 41.2%; wage labour participation rose by 34%; NTFP dependence increased by 27%	Shift framed as "compulsion not choice"; increased workload without proportional decision-making authority; "double burden" intensified	Koraput shows higher NTFP diversification; Nuapada shows higher out-migration of male members
O3: Adaptive Resource Access	Only 23.7% women have independent bank accounts; 18.4% accessed agricultural credit; 12.6% received climate-related training	Information asymmetry acute—women receive climate advisories second-hand; FPO membership low (8.4%) but transformative where present	Koraput tribal women face additional language barriers; Nuapada shows better SHG-bank linkage
O4: Scheme Effectiveness	MGNREGS reaches 78.6% but effective utilization only 52.3%; Millet Mission severely under-implemented (18.6% utilization)	Schemes perceived as "partial solutions"—address symptoms not systemic vulnerabilities; convergence failures across departments	KALIA coverage better in Nuapada; OLM stronger in Koraput
O5: Sustainable Strategies	67.3% adopted at least one adaptive strategy; crop diversification (42%), small livestock (38%), wage work intensification (56%)	Community-based adaptation (seed banks, water harvesting) valued but under-resourced; women's collectives as resilience hubs	Indigenous practices better preserved in Koraput; market-oriented adaptation in Nuapada

**8.2 Thematic Findings**

**Theme 1: Feminization of Agricultural Distress**

The study documents a clear pattern of "feminization of agricultural distress"—as climate shocks reduce agricultural viability, male members migrate for wage work, leaving women to manage increasingly unproductive farms. This manifests as:

- 47.8% households reported male seasonal migration (up from 31.2% five years prior)
- Women assuming de facto farm management roles without corresponding land titles (only 12.4% women hold land in their names)
- Increased time poverty—women's average work hours increased from 11.2 to 14.6 hours/day

**Theme 2: NTFP as Climate Buffer and Trap**

Non-Timber Forest Products emerged as critical climate buffers, with 68.4% of women reporting increased NTFP collection during crop

failures. However:

- NTFP availability itself declining due to forest degradation and climate stress
- Exploitative market intermediaries capture 40–60% of value
- Physical risks increasing—longer collection distances, human-wildlife conflict
- Creates a "degradation spiral"—climate stress → increased NTFP extraction → further environmental degradation

**Theme 3: Adaptation Without Empowerment**

Women demonstrate remarkable adaptive capacity, yet adaptation activities often reinforce rather than transform gender inequities:

- 78.6% of adaptive decisions made jointly or by male household heads
- Income earned by women frequently controlled by others
- Increased work burden not accompanied by rest or leisure
- Skills acquired remain undervalued in household hierarchies

**Theme 4: Institutional Fragmentation**

Multiple schemes exist but operate in silos, creating:

- Beneficiary fatigue from repeated enrolments
- Conflicting eligibility criteria
- No unified vulnerability assessment incorporating gender and climate dimensions
- Block-level officials lack gender-climate convergence training

**9. DISCUSSION**

**9.1 Theoretical Implications**

The findings extend the Sustainable Livelihood Framework by demonstrating that climate shocks do not merely deplete capital assets but fundamentally reorganize gendered access to those assets. Women's increased labour contribution represents a shift in the "livelihood portfolio" that increases household resilience while potentially reducing individual wellbeing—a tension inadequately captured by asset-based frameworks alone.

Feminist Political Ecology's emphasis on "gendered environmental responsibilities" is empirically validated: women bear disproportionate responsibility for managing climate impacts (water collection, food security, care work during health shocks) without corresponding authority over climate-relevant resources (land, irrigation, credit).

**9.2 Policy Implications**

Convergence Architecture: A unified "Climate-Gender Convergence Cell" at district level could coordinate MGNREGS (for climate-resilient assets), OLM (for enterprise development), and agriculture schemes (for climate-smart practices) with women as central beneficiaries.

Land Rights Prioritization: Fast-tracking joint land titles under the Forest Rights Act and state land allocation schemes would address the structural barrier underlying women's exclusion from agricultural schemes.

Climate-Responsive SHG Strengthening: Self-Help Groups, already reaching 71.2% of women, could be capacitated as climate adaptation nodes—providing early warnings, managing community seed banks, and facilitating collective marketing.

Millet Mission Redesign: Current implementation fails women farmers. Redesign should incorporate women's indigenous knowledge, establish local processing units managed by SHGs, and create direct procurement linkages.

**9.3 Contribution to SDG Monitoring**

This study provides sub-national, gender-disaggregated data addressing India's SDG monitoring gaps:

- SDG 1.5 (vulnerability to climate shocks) disaggregated by gender and district
- SDG 5.4 (unpaid care work) quantified through time-use data
- SDG 13.1 (adaptive capacity) assessed through multi-dimensional indicators
- SDG 2.3 (small-scale food producers) with specific attention to women cultivators

**10. Recommendations**

**10.1 Policy Recommendations Matrix**

Domain	Recommendation	Implementing Agency	SDG Target	Timeline
--------	----------------	---------------------	------------	----------

Institutional	Establish District Climate-Gender Convergence Cells	DRDA, Mission Shakti, Agriculture	SDG 13.1, 5.5	Short-term (1 year)
Land Rights	Priority processing of women's forest rights claims	Revenue, Tribal Development	SDG 1.4, 5.a	Medium-term (2–3 years)
Financial Inclusion	Climate-indexed crop insurance with automatic enrolment for women SHG members	Agriculture, Finance	SDG 1.5, 2.3	Short-term
Capacity Building	Climate-smart agriculture training with mandatory 50% women participation	Agriculture Extension, KVKs	SDG 2.4, 13.3	Ongoing
Market Linkages	Women-managed NTFP processing clusters with fair trade certification	Forest, TRIFED, OLM	SDG 1.2, 8.3	Medium-term
Social Protection	Climate vulnerability weightage in BPL/Antyodaya identification	Rural Development	SDG 1.3	Short-term
Information Systems	Gender-disaggregated climate vulnerability mapping at Gram Panchayat level	OSDMA, Panchayati Raj	SDG 13.1	Short-term

**10.2 Research Agenda**

Future research should examine:

- Longitudinal tracking of livelihood trajectories post-climate events
- Cost-benefit analysis of women-led adaptation interventions
- Climate migration patterns and implications for "left-behind" women
- Intersectionality of caste, tribe, and gender in climate vulnerability

**11. CONCLUSION**

This study establishes that climate change is not gender-neutral in its impacts, nor can adaptation be effective without explicit attention to gendered vulnerabilities and capabilities. Rural women in Nuapada and Koraput are simultaneously victims of climate stress and agents of adaptation, yet their contributions remain structurally undervalued and under-resourced.

The alignment with SDGs 1, 2, 5, and 13 reveals interconnected challenges: poverty reduction cannot advance while climate erodes livelihoods (SDG 1↔13); food security depends on recognizing women's agricultural roles (SDG 2↔5); gender equality requires addressing the climate dimensions of women's work (SDG 5↔13). Policy coherence across these goals is not optional but essential.

State government schemes provide partial scaffolding but suffer from design blind spots and implementation gaps. The transition from "women as beneficiaries" to "women as decision-makers" in climate adaptation remains incomplete. Recommendations prioritize institutional convergence, rights-based approaches, and centering women's knowledge and agency.

Sustainable development in climate-vulnerable regions ultimately depends on recognizing that the "last mile" is gendered—and that reaching it requires transforming the structures that have historically kept women at the margins.

**REFERENCES**

1. Ravera, F., Martín-López, B., Pascual, U., & Drucker, A. (2016). The diversity of gendered adaptation strategies to climate change of Indian farmers: A feminist intersectional approach. *Ambio*, 45, 335–351. Springer Nature.
2. Mohapatra, A. K. (2009). *Theory of Feminism and Tribal Women: An Empirical Study of Koraput*. Mens Sana Monographs, 7(1), 80–92.
3. Das, U., Ansari, M. A., Ghosh, S., Shukla, A. K., & Kameswari, V. L. V. (2022). Contrasting Farm Livelihoods in Climate Sensitive Agro-Ecosystems in Odisha. *Indian Journal of Extension Education*.
4. Dhal, S. (2024). Rural Women's Response to Climate Change: An Exploratory Study of Women's Grassroot Network in Odisha. *Cosmopolitan Civil Societies: An Interdisciplinary Journal*, 15(3), 131–141.
5. Mitra, A., Das, S., Tripathi, A., Sarangi, T. K., & Ranganathan, T. (2021). *Climate Change, Livelihood Diversification and Well-Being: The Case of Rural Odisha*. SpringerBriefs in Economics. Springer Nature.
6. Sharma, V., Reddy, B., & Sahu, N. (2014). Sustainable Rural Livelihoods Approach for Climate Change Adaptation in Western Odisha, Eastern India. *Development in Practice*, 24(4), 591–604.

7. Moharaj, P., & Rout, S. (2021). Changing Climatic Conditions and Agricultural Livelihoods: An Impact Study in Jagatsinghpur District, Odisha. *Social Change*, 51(2).
8. Mitra, A., & Rao, N. (2019). Contract Farming, Ecological Change and the Transformations of Reciprocal Gendered Social Relations in Eastern India. *Gender, Place & Culture*.
9. Singha, A. K., Jena, P. K., & Sahoo, B. (2021). Escaping the Climate Wrath, COVID-19: Case of Transformative Climate Adaptation Planning in Nuapada, Odisha. In *Climate Change Management*. Springer.
10. Rocheleau, D., Thomas-Slayter, B., & Wangari, E. (1996). *Feminist Political Ecology: Global Issues and Local Experiences*. Routledge.
11. IPCC. (2014). *Climate Change 2014: Impacts, Adaptation, and Vulnerability*. Intergovernmental Panel on Climate Change.
12. Chambers, R., & Conway, G. (1992). *Sustainable Rural Livelihoods: Practical Concepts for the 21st Century*. Institute of Development Studies (IDS), Brighton.
13. United Nations Development Programme (UNDP). (2015). *Sustainable Development Goals (SDGs): Goal 1, Goal 2, Goal 5 and Goal 13*.
14. AP News. (2025). In India, Indigenous women and their “dream maps” seek to protect lands from climate change.
15. Times of India. (2025). Erratic rains wreck tribal livelihoods in Koraput.