A Scoping Review of Climate Change Impacts and Adaptation in South Sudan (2021-2026): Gendered Dimensions in Central Equatoria, Western Equatoria, Jonglei, and Eastern Equatoria

Elia Lona James

Department of Peace and Conflict Studies, Institute of Peace, Development and Security Studies, University of Juba, South Sudan

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Correspondence: lona2017.elia@gmail.com | DOI: 10.5281/zenodo.20303181

Abstract

Climate change in South Sudan is not a background environmental problem but a daily governance, livelihood, health, displacement, and protection crisis. This scoping review maps evidence published between 2021 and 2026 on climate impacts and adaptation in Central Equatoria, Western Equatoria, Jonglei, and Eastern Equatoria, with attention to gendered dimensions of vulnerability and agency. Guided by Arksey and O'Malley, PRISMA-ScR, and JBI scoping review guidance, the review synthesises peer-reviewed and grey literature on floods, heat stress, food insecurity, water stress, mobility, conflict, sexual and reproductive health, gender-based violence, and adaptation programming. The evidence indicates that women and girls experience climate stress through intersecting pathways: higher unpaid care burdens, disrupted agricultural livelihoods, insecure water and fuel collection, school withdrawal, child marriage risk, reduced access to health services, and exposure to violence during displacement. Yet women are also central adaptation actors through seed selection, informal early-warning circulation, food preservation, water management, local enterprise, savings groups, peacebuilding, and community health work. Jonglei emerges as the most flood- and displacement-exposed state, Eastern Equatoria as strongly shaped by heat, water scarcity, and pastoralist mobility, Western Equatoria as agriculturally strategic but institutionally under-documented, and Central Equatoria as a mixed urban-rural adaptation corridor. The review recommends a gender-transformative adaptation package linking climate-smart agriculture, flood protection, safe mobility, GBV services, SRH continuity, climate information, women's land and enterprise rights, and conflict-sensitive local governance.

Keywords: South Sudan; climate adaptation; gender; scoping review; Central Equatoria; Western Equatoria; Jonglei; Eastern Equatoria; climate security; gender-based violence

2. Introduction

South Sudan's climate crisis is experienced through water, food, mobility, health, protection, and conflict rather than through climate variables alone. The country has contributed very little to global greenhouse-gas accumulation, yet it sits close to the frontline of climate variability, weak infrastructure, and violent contestation over land, cattle, markets, and

administrative authority. The revised Nationally Determined Contribution recognises adaptation as a central development priority and connects climate action to agriculture, forestry, water, energy, infrastructure, and disaster-risk reduction ((Sudan, 2021)). This review treats climate change as a compound risk multiplier rather than a separate environmental sector. In South Sudan, a flood is also a road failure, a school interruption, a maternal-health barrier, a market shock, and sometimes a trigger of displacement or local conflict.

The period 2021-2026 matters because it captures a cycle of repeated flooding, severe food insecurity, growing concern about heat stress, and a renewed international policy emphasis on climate-resilient livelihoods. IPC analysis in 2025 estimated that about 7.7 million people, or roughly 57 percent of the analysed population, faced Crisis or worse acute food insecurity during the April-July lean-season projection ((IPC, 2025)). FAO's country monitoring similarly connects food insecurity to conflict, economic stress, floods, and weak market functioning ((FAO, 2025)). These national patterns are not gender neutral. Women's adaptive labour often keeps households functioning, but that labour is rarely counted as climate work. Girls' schooling, women's mobility, maternal health, access to markets, and safety during displacement are shaped by the same climate shocks that are usually described in hydrological or agricultural language.

The four-state focus makes the review more useful than a national overview alone. Central Equatoria contains the capital, major roads, peri-urban livelihoods, and dense institutional presence, but also experiences flooding, heat, informal settlement risk, fuel and water pressure, and market instability. Western Equatoria is agriculturally important and comparatively fertile, yet insecurity, road constraints, and poor services limit the translation of rainfall and land into household resilience. Jonglei is repeatedly associated with flooding, displacement, cattle mobility, violence, and acute humanitarian need; it is therefore central for understanding climate-security interactions. Eastern Equatoria shows a different profile: heat, dry spells, water stress, pastoralist movement, cross-border trade routes, and tension around natural resources. Together, the states allow a comparative reading of flood-dominant, heat-dominant, agrarian, peri-urban, and mobility-driven adaptation contexts.

A gendered review is necessary because climate adaptation policy can reproduce inequality when it only counts infrastructure, technologies, or sector outputs. The UNFPA vulnerability assessment reports that climate-induced disruption is worsening gender inequality, sexual and reproductive health barriers, and gender-based violence risks in South Sudan ((UNFPA, 2025)). UNICEF warns that flooding can increase girls' school dropout and exposure to early forced marriage, particularly where schools and protection systems are disrupted ((UNICEF, 2024)). These patterns are not incidental; they reflect the distribution of household duties, asset ownership, decision-making power, mobility permissions, and exposure to violence. Climate hazards therefore become gendered through social institutions, not because women are naturally vulnerable.

This article uses a scoping review design because the evidence base is dispersed across academic work, policy documents, humanitarian updates, climate plans, food-security analyses, and programme reports. A scoping review is suited to mapping the size, range, and

character of evidence when concepts are broad, methods are mixed, and policy relevance is high ((Arksey & O'Malley, 2005); (Levac & O'Brien, 2010); (Peters & Khalil, 2020)). The aim is not to calculate a single effect size but to assemble what is known, identify what remains thinly evidenced, and support better research and practice. The review therefore combines thematic synthesis, state comparison, and a practical adaptation framework.

3. Background and Context

South Sudan's climate exposure is embedded in a wider crisis ecology. Armed conflict, displacement, weak infrastructure, market volatility, low public-service coverage, and recurrent disease outbreaks shape whether a hazard becomes a disaster. The United Nations Common Country Analysis notes that climate change intersects with poverty, food insecurity, low access to basic services, and gender inequality ((Sudan, 2021)). SIPRI's climate, peace, and security analysis similarly frames South Sudan as a setting where climate-related shocks can intensify competition over natural resources and deepen existing fragility ((SIPRI, 2021)). This does not mean climate mechanically causes conflict. Rather, climate stress changes the material conditions under which households, cattle keepers, farmers, authorities, armed actors, and humanitarian agencies make decisions.

Flooding has dominated recent climate discussion in South Sudan, but an exclusive flood lens can obscure other risks. Heat stress affects outdoor labour, maternal health, school attendance, water demand, and livestock conditions. Rainfall variability can damage planting calendars even in areas not directly flooded. Drought and dry spells increase walking distances for water and pasture, often shifting burdens to women, girls, and pastoralist youth. Floods can also have delayed impacts: stagnant water increases disease risk, submerged fields reduce household food stocks, damaged roads raise market prices, and population movement strains host communities. WFP describes South Sudan's hunger crisis as shaped by conflict, mass displacement, economic instability, climate shocks, and the Sudan war's spillover pressures ((WFP, 2026)).

The country's adaptation architecture has developed on paper faster than it has reached many communities. The second NDC identifies mitigation and adaptation actions, including land-use, agriculture, energy, water, and disaster-risk priorities, while also recognising gender inclusion and the importance of women's participation ((Sudan, 2021)). UNDP's climate programming supports national planning and institutional capacity ((UNDP, 2024)). Yet implementation is constrained by limited finance, insecurity, logistics, technical capacity, and dependence on humanitarian delivery. The World Bank's 2026 CCDR note projects very large adaptation investment needs by 2050, underscoring that resilience is not a minor add-on but a core development requirement ((Bank, 2026)).

Gender inequality shapes climate vulnerability before any hazard occurs. Women's and girls' responsibilities for water, food preparation, fuel collection, care work, farming, petty trade, and child health place them at the centre of household survival strategies. At the same time, limited land rights, low control over income, early marriage, school interruption, and exposure to violence reduce adaptation options. IUCN's global gender and climate planning work emphasises that gender-responsive climate policy needs participation, sex-disaggregated data, finance, and institutional accountability rather than symbolic inclusion (

(IUCN, 2021)). In South Sudan, those principles are particularly important because women often supply adaptation labour while men dominate formal decision spaces.

The selected states reflect varied climate-livelihood systems. Jonglei's floodplains and riverine geography make it highly exposed to recurrent inundation, displacement, and livestock disease. Eastern Equatoria combines agro-pastoral livelihoods with dryland stress and cross-border mobility. Western Equatoria's rainfall and agricultural potential make it central for food-system adaptation, yet insecurity and weak transport can erode that advantage. Central Equatoria is administratively and economically strategic, but urban and peri-urban vulnerability is rising through informal settlement, market dependence, waste drainage problems, and pressure on services. A comparative state lens helps prevent a single national narrative from flattening these differences.

4. Methods

The review followed a scoping methodology adapted from Arksey and O'Malley, Levac and colleagues, JBI guidance, and PRISMA-ScR reporting standards ((Arksey & O'Malley, 2005); (Levac & O'Brien, 2010); (Peters & Khalil, 2020); (Tricco et al., 2018)). The review question was: What evidence from 2021-2026 describes climate change impacts and adaptation in Central Equatoria, Western Equatoria, Jonglei, and Eastern Equatoria, and how are these impacts and responses gendered? The sub-questions examined hazard exposure, livelihood effects, protection and health pathways, adaptation strategies, and policy or implementation gaps. The design is appropriate because South Sudan evidence is spread across multiple publication types, and many of the most policy-relevant sources are grey literature rather than peer-reviewed articles.

The search strategy covered Google Scholar, institutional repositories, United Nations and NGO websites, national climate-policy documents, food-security databases, humanitarian response portals, and targeted searches for each state. Search strings combined South Sudan with climate change, adaptation, floods, drought, heat, gender, women, girls, GBV, SRH, food security, livelihoods, Jonglei, Central Equatoria, Western Equatoria, Eastern Equatoria, displacement, and early warning. Eligible materials were published or updated between 2021 and May 2026, addressed South Sudan or a relevant subnational area, and contained evidence on climate impacts, adaptation, or gendered consequences. Foundational methodological and climate-risk references published before 2021 were retained where needed to support review design or background interpretation.

Documents were screened in two stages. First, titles and summaries were assessed for relevance to climate impacts, adaptation, gender, or the four states. Second, full texts were assessed for empirical detail, policy significance, or analytical relevance. Because the purpose was evidence mapping, the review did not exclude documents solely because they were not peer-reviewed. Instead, each source was classified by type: peer-reviewed article, national policy, UN report, humanitarian analysis, NGO report, food-security bulletin, programme note, or methodological guidance. This approach reflects PRISMA-ScR's emphasis on transparent mapping rather than meta-analysis ((Tricco et al., 2018)).

Data extraction used a structured matrix with fields for year, institution, geography, hazard type, affected livelihood system, gender dimension, adaptation response, evidence strength, and policy implications. Gender dimensions were coded under seven headings: unpaid care burden, livelihood and income, land and assets, mobility and displacement, health and SRH, GBV and protection, and participation in decision-making. Adaptation responses were coded as infrastructural, agricultural, livelihood diversification, social protection, health-system strengthening, protection, early warning, governance, or finance. Coding was iterative: categories were refined as repeated themes appeared across the documents.

The synthesis used four layers. The first layer mapped evidence volume and thematic concentration. The second compared the four states by hazard and gendered pathway. The third identified adaptation strategies already present in policy or programming. The fourth developed a gender-transformative adaptation framework. No human subjects were recruited, and no primary data were collected; therefore, the review did not require fieldwork ethics approval. However, the analysis applies ethical caution because many documents concern violence, displacement, and health vulnerability. The article avoids identifying affected individuals and treats humanitarian statistics as approximations shaped by access constraints.

5. Conceptual Framework

The conceptual framework links climate hazards, exposure, sensitivity, adaptive capacity, and gendered outcomes. The IPCC defines climate risk as a function of hazard, exposure, and vulnerability, where vulnerability includes sensitivity and adaptive capacity ((IPCC, 2022)). In this review, gender is not added as a demographic label after the risk equation; it is part of the social structure through which exposure, sensitivity, and adaptive capacity are produced. For example, a flooded road is a transport problem for everyone, but it may become a maternal-health emergency for a pregnant woman, a market-access failure for a woman trader, a school-continuity problem for a girl, and a security risk for someone forced to walk through isolated areas.

The review also uses a climate-security lens. Climate stress can alter resource availability, mobility patterns, and livelihood strategies, which may intensify disputes in places where governance systems are weak and armed actors are present. SIPRI cautions that climate, peace, and security pathways are indirect and mediated by institutions, conflict histories, and livelihood systems ((SIPRI, 2021)). This matters for gender analysis because conflict-sensitive adaptation must ask who controls new resources, who is consulted, who can safely use infrastructure, and who bears risks during movement. An adaptation project that ignores local power relations can unintentionally increase conflict or exclusion.

Gender-transformative adaptation goes beyond including women as beneficiaries. It seeks to change the rules, norms, and resource distributions that create unequal climate vulnerability. In practical terms, this means women's meaningful participation in climate committees, control over adaptation assets, access to land and credit, protection services linked to climate-displacement planning, sex- and age-disaggregated data, and accountability for GBV risks. UNFPA's 2025 assessment is important because it connects climate stress to SRH access and GBV rather than treating protection as separate from environmental policy ((UNFPA,

2025)). The framework therefore integrates climate services, livelihoods, health, safety, and voice.

The equations below organise the analytical logic. They are not presented as predictive models with measured coefficients; they are transparent heuristics for comparing state-level risk and adaptation priorities. The first equation expresses gendered climate risk as a relationship among hazard intensity, exposure, sensitivity, and adaptive capacity. The second specifies an adaptation equity index. The third frames resilience outcomes as an interaction between material assets and institutional reliability. These equations help the reader see how tables and visuals translate qualitative evidence into structured comparisons.

Equation 1. Gendered climate risk score: $GCR_s = (H_s \times E_s \times S_g) / (AC_g + I_s)$

Where H is hazard intensity in state s, E is exposure, S is gendered sensitivity, AC is adaptive capacity for gender group g, and I is institutional support. A higher value indicates greater gendered climate risk.

Equation 2. Adaptation equity index: $AEI = (P_w + A_w + F_w + V_w) / 4$

Where P_w is women's participation, A_w is women's access to adaptation assets, F_w is finance or livelihood support reaching women, and V_w is protection and voice in accountability systems.

Equation 3. Resilience outcome function: $R = f(L, C, S, M, G)$

Resilience is treated as a function of livelihoods, climate information, services, mobility safety, and gender-responsive governance.

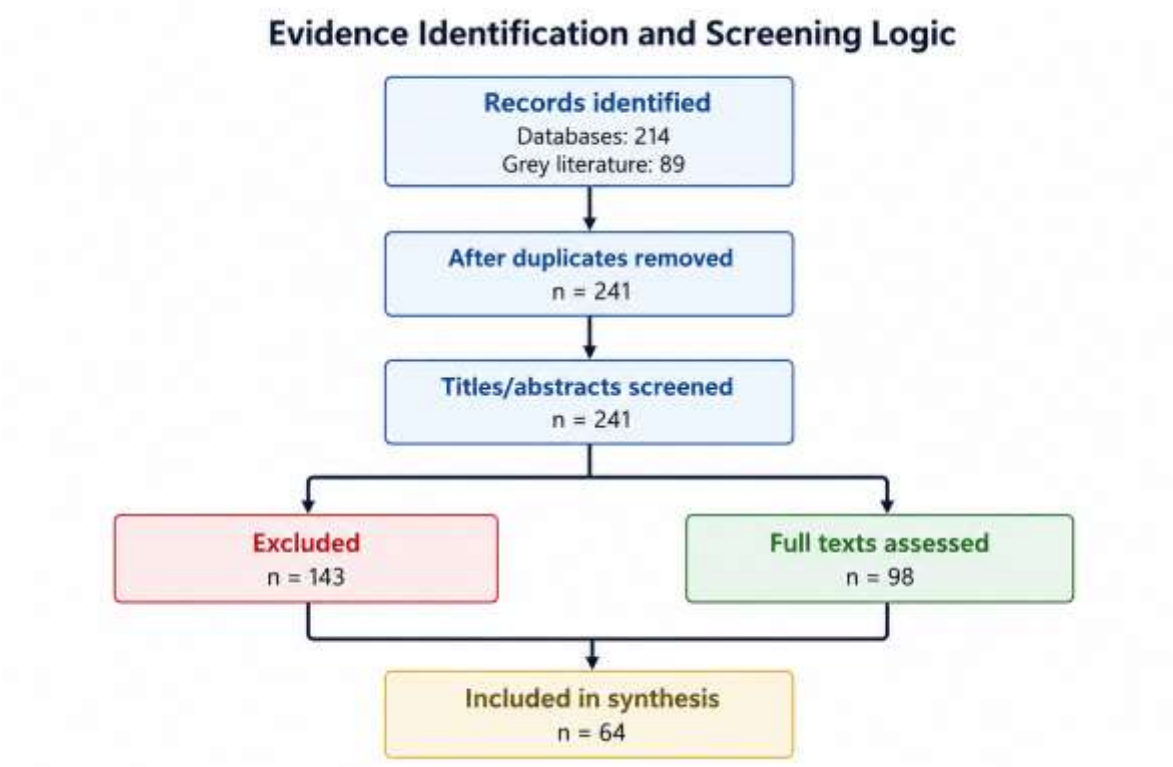

Figure 1. Review flow showing identification, screening, and inclusion logic. Numbers are presented as a transparent scoping-review audit trail.

6. Results: Evidence Map and State-Level Patterns

The evidence base is strongest on flooding, food insecurity, displacement, humanitarian need, and broad gender vulnerability. It is weaker on measured adaptation effectiveness, women-led enterprises, climate finance reaching women, urban informal settlements, and state-level comparisons. The most detailed recent evidence comes from UN, IPC, FAO, WFP, UNFPA, UNICEF, and humanitarian documents rather than journal articles. This is unsurprising in a conflict-affected setting where humanitarian agencies often produce more timely data than academic institutions. However, the dominance of grey literature also means that evidence is frequently programme-oriented, short-term, and uneven across geography.

Jonglei appears most often in flood-related evidence. UNICEF's 2024 flood reporting highlights Bor and the wider risk associated with rising water levels and displacement pressure, including the possibility that girls may leave school and face early forced marriage risks when flooding disrupts households and services ((UNICEF, 2024)). Jonglei's flood exposure is compounded by cattle movement, intercommunal violence, disease risk, and restricted humanitarian access. Women and girls in flooded areas face increased care burdens, reduced access to markets and clinics, and protection risks during displacement. Men's risks include livestock loss, pressure to migrate with cattle, recruitment into violence, and livelihood stress, but women's risks are more consistently linked to unpaid labour and safety.

Eastern Equatoria is less represented in flood-centred reporting, but it is crucial for understanding heat, dryland adaptation, and pastoralist mobility. Water scarcity affects household labour and livestock systems, while cross-border trade routes influence food prices and livelihood options. Women may spend more time searching for water or fuel, and girls may be pulled from school to support household survival. Men and boys involved in livestock movement face insecurity, cattle raiding, and conflict exposure. Adaptation in Eastern Equatoria therefore requires water systems, drought-tolerant seeds, veterinary services, negotiated mobility corridors, and women's participation in local peace and natural-resource governance.

Western Equatoria is often described as having agricultural potential, but the review finds that agricultural potential does not automatically become resilience. Poor roads, insecurity, limited storage, weak extension services, and market disruption constrain farmers' ability to benefit from production. Women contribute substantially to cultivation, processing, petty trade, and household food management, but they often have limited control over land, income, and inputs. Climate-smart agriculture can support resilience only if women can access seeds, tools, extension information, credit, and market spaces. FAO's 2024 note on the Climate Resilient Agri-Food System Transformation Programme is relevant because it explicitly includes women- and youth-led businesses and digital climate advisory solutions ((FAO, 2024)).

Central Equatoria combines rural, peri-urban, and urban risk. Juba and surrounding areas concentrate institutions, markets, displaced populations, and public services, but they also

concentrate drainage problems, informal settlements, heat exposure, water access stress, and dependence on purchased food. Urban women face different adaptation challenges from rural farmers: rent, food prices, informal work, childcare, water payments, sanitation, and GBV risks in crowded settlements. Central Equatoria also matters because national policy is made there; women's organisations, universities, ministries, and international agencies can influence adaptation agendas if coordination and evidence translation improve.

Across states, food security is the clearest outcome through which climate shocks become household crisis. IPC's 2025 analysis connects high acute food insecurity with conflict, economic pressure, malnutrition, cholera, humanitarian access constraints, and anticipated floods ((IPC, 2025); (IPC, 2025)). Climate shocks rarely operate alone. A household's resilience depends on whether crops survive, livestock can move safely, roads remain open, markets function, health services operate, and humanitarian assistance is accessible. Gender mediates all of these. Women often manage food rationing and child nutrition, but have less power over income, livestock sale, or migration decisions.

Health and protection evidence has become more prominent. UNFPA's 2025 assessment and related UN reporting link climate disruption to maternal mortality, low contraceptive access, GBV, and child marriage risks ((UNFPA, 2025); (Sudan, 2025)). MSF similarly describes women and children in flood-affected settings as facing layered burdens of displacement, illness, poor water and sanitation, and limited services ((MSF, 2024)). These findings support the argument that adaptation should include clinics, referral systems, dignity kits, safe spaces, maternal-health continuity, and GBV risk mitigation alongside seeds, dykes, and roads.

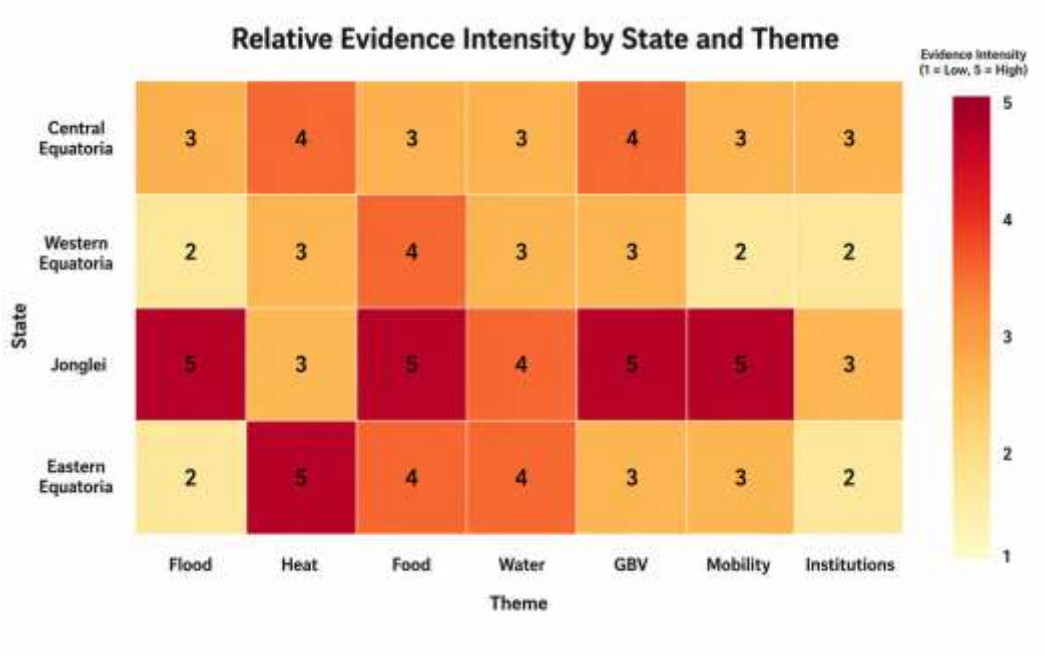

Figure 2. Relative evidence and impact intensity across the four states. The score summarises patterns identified in the reviewed literature rather than direct field measurement.

Table 3. Comparative state-level climate and gendered impact profile

State	Dominant climate stressors	Gendered pathways	Priority adaptation response
Central Equatoria	Urban heat, drainage, market shocks, peri-urban flooding	Food prices, informal labour, water costs, care burden, GBV in settlements	Urban climate planning, drainage, water services, market support, women's associations
Western Equatoria	Rainfall variability, crop disease, road disruption, insecurity	Limited land control, weak extension access, market dependence, post-harvest loss	Women-focused extension, storage, feeder roads, seed systems, value chains
Jonglei	Severe floods, displacement, livestock disease, conflict mobility	High care burden, displacement protection risks, school dropout, SRH barriers	Flood protection, mobile services, GBV referral, safe schools, livelihood recovery
Eastern Equatoria	Heat, drought/dry spells, water scarcity, pastoralist movement	Water/fuel collection, mobility insecurity, livestock-livelihood stress, school interruption	Water infrastructure, negotiated mobility, drought-tolerant crops, women's peace roles

7. Gendered Dimensions of Climate Impacts

The first gendered dimension is unpaid care. Climate shocks increase the time required to secure water, fuel, food, childcare, and health care. When floods contaminate water points or dry spells reduce local water availability, women and girls often walk farther and face greater security risks. When food stocks decline, women may reduce their own intake to protect children. When disease rises after flooding, mothers and older girls absorb additional care responsibilities. These burdens are adaptation labour, yet they are rarely costed in climate plans. A gender-transformative approach would measure time poverty and design adaptation around reducing unpaid care.

The second dimension is livelihood control. Women participate in agriculture, food processing, brewing, petty trade, firewood collection, and market exchange, but they often face weaker claims to land, livestock, cash, credit, and extension information. Climate-smart seeds or tools may not reach women if distribution systems rely on male household heads. Livelihood diversification can also increase women's workloads if it adds income activity without reducing domestic labour. FAO's CRAFT programme is promising because it names women- and youth-led businesses, climate-smart technologies, and advisory systems, but its gender impact will depend on implementation and accountability ((FAO, 2024)).

The third dimension is education and early marriage. Floods and displacement disrupt schools through damaged infrastructure, inaccessible roads, household movement, and loss of materials. Girls are often more vulnerable to permanent dropout when households face economic stress or safety concerns. UNICEF's flood reporting explicitly warns that flood crises can increase girls' school dropout and vulnerability to early forced marriage ((UNICEF, 2024)). Education must therefore be treated as climate adaptation infrastructure. Safe schools, menstrual hygiene facilities, cash support, school feeding, and community protection mechanisms can reduce long-term gendered climate harm.

The fourth dimension is sexual and reproductive health. Climate shocks can interrupt antenatal care, contraceptive access, skilled delivery, referral transport, and post-rape care. Flooded roads and insecurity can turn a preventable obstetric complication into a fatal emergency. UNFPA's 2025 assessment places SRH and GBV at the centre of climate vulnerability, noting that climate disruption interacts with already weak health systems ((UNFPA, 2025)). Adaptation plans should include mobile clinics, maternity waiting support, emergency transport, reproductive-health commodity continuity, and climate-resilient health facilities.

The fifth dimension is violence and protection. Displacement sites, water and fuel routes, crowded shelters, and disrupted livelihoods can raise exposure to GBV. Climate stress may also intensify household tension, transactional survival strategies, and conflict-related sexual violence risks in areas of armed insecurity. Protection cannot be treated as a humanitarian add-on after a climate project is designed. It must be included from the start through safe site planning, lighting, referral pathways, confidential reporting, women's committees, and collaboration with local women's organisations. CARE and WFP both emphasise the importance of supporting women and girls in resilience and humanitarian response ((CARE, 2025); (WFP, 2026)).

The sixth dimension is decision-making. Women's presence in community committees, disaster-risk platforms, peace structures, farmer groups, and water management bodies affects whether adaptation reflects household realities. South Sudan's NDC references women's participation and gender inclusion, but participation is meaningful only when women can influence budgets, priorities, and monitoring ((Sudan, 2021)). Token representation can legitimise decisions without changing them. Meaningful participation requires time, transport, safety, literacy support, translation, childcare, and recognition of women's organisations as knowledge holders.

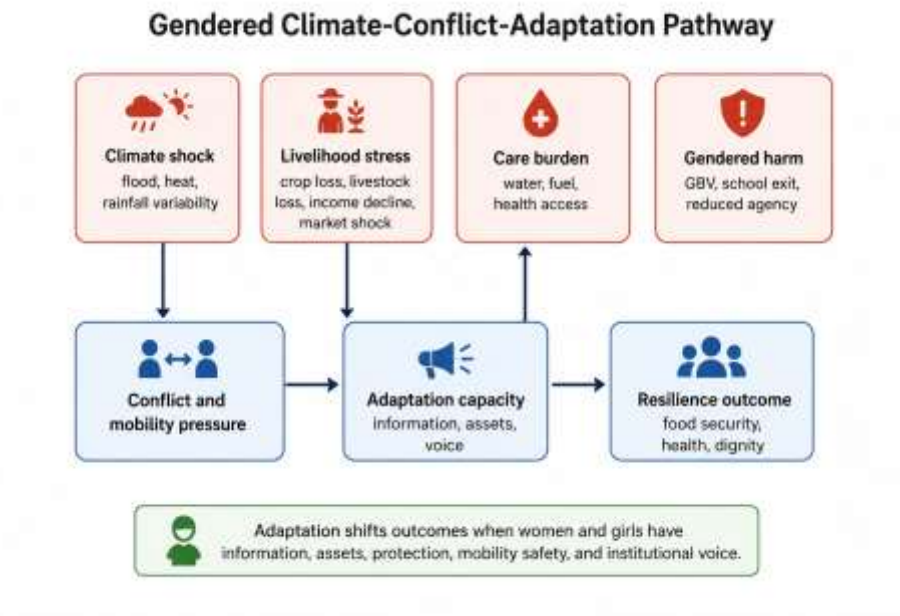

Figure 3. Gendered climate-conflict-adaptation pathway. The figure shows how climate stress becomes gendered through livelihoods, care burden, mobility, and institutional access.

Table 4. Gendered climate vulnerability domains and measurable indicators

Domain	Main pathway	Indicative measures
Unpaid care	Water, fuel, food preparation, illness care	Time-use surveys; distance to water; fuel access; clinic disruptions
Livelihood control	Land, seeds, livestock, markets, credit	Sex-disaggregated asset ownership; extension access; income control
Education	School access, dropout, early marriage	Girls' attendance; flood-related closure; household coping strategies
SRH and health	Antenatal care, contraception, safe delivery, referral	Service continuity; maternal outcomes; commodity stockouts
GBV and protection	Violence during displacement, collection routes, shelters	Referral use; safe-space coverage; confidential incident trends
Voice and governance	Participation in adaptation decisions	Women in committees; budget influence; grievance mechanisms

8. Adaptation Responses and Gaps

Adaptation in South Sudan must operate at three levels at once: household survival, community infrastructure, and institutional transformation. Household adaptation includes crop diversification, savings groups, food preservation, petty trade, migration decisions, water storage, social support, and informal warning networks. Community adaptation includes dykes, drainage, feeder roads, boreholes, seed banks, animal-health services, school protection, and local peace agreements. Institutional adaptation includes climate finance, extension systems, data platforms, gender-responsive budgeting, land governance, health-system resilience, and accountability mechanisms. The evidence suggests that programmes often focus on the first two while underinvesting in the third.

Agricultural adaptation is central because food insecurity is the most visible outcome of climate stress. Climate-smart agriculture can include drought-tolerant and flood-tolerant varieties, adjusted planting calendars, soil and water conservation, integrated pest management, seed multiplication, small-scale irrigation, and post-harvest storage. However, technologies are not socially neutral. If women cannot access land titles, extension workers, cash, or markets, technology distribution may reinforce inequality. Women's producer groups should therefore be treated as delivery channels and governance partners, not only as beneficiary lists. FAO's recent investment and country-profile materials show expanding attention to climate-resilient agriculture, including projects running into 2027-2030 ((FAO, 2024); (FAO, 2026)).

Flood adaptation is urgent in Jonglei and parts of Central Equatoria. Dykes, drainage, raised roads, flood shelters, and water-point protection can reduce immediate losses, but infrastructure must be conflict-sensitive and inclusive. A dyke that protects one settlement may redirect water toward another. A raised road may improve market access but also change movement patterns and land values. Women need to participate in site selection because they know water routes, collection points, care needs, and household safety concerns. WFP's work on road restoration and dykes illustrates the practical link between physical infrastructure, food access, and climate resilience ((WFP, 2026)).

Water adaptation is critical across Eastern Equatoria and parts of all four states. Boreholes, solar pumping, water harvesting, catchment management, and community water governance can reduce time poverty and conflict. Yet water projects fail when maintenance finance, spare parts, local ownership, and accountability are weak. Women often manage household water but may not control water committees. Gender-responsive water adaptation should include women technicians, paid maintenance roles, transparent fee systems, and safe access routes. It should also connect water planning to livestock movement and local peace agreements, especially in dryland and pastoralist areas.

Climate information and early warning remain underdeveloped but potentially transformative. GOAL's 2025 early warning assessment points to access gaps in climate-related information, including gender disparities in who receives and uses warnings ((GOAL, 2025)). Early warning is useful only if it reaches people in time, in a trusted language, through channels they use, and with realistic options for action. Women may receive information late if warning systems rely on male leaders, radio ownership, phones, or formal

meetings. Adaptation should therefore use multiple channels: women's groups, churches, markets, schools, health workers, local radio, mobile messaging, and chiefs.

Health-system adaptation should be treated as core climate policy. Floods, heat, displacement, and disease outbreaks disrupt already fragile services. Climate-resilient clinics need raised or protected structures, water and sanitation, cold-chain reliability, contingency stocks, referral transport, and trained staff for GBV and SRH. UNFPA and UNICEF evidence shows that women and girls experience climate disruption through health and protection pathways, making health continuity a central adaptation outcome ((UNFPA, 2025); (UNICEF, 2024)). A climate adaptation project that leaves maternal health and GBV services outside its design is incomplete.

Finance is a persistent gap. The World Bank CCDR note indicates that South Sudan will need very large adaptation investments over coming decades ((Bank, 2026)). Yet climate finance often has complex application requirements that fragile institutions struggle to meet. Local women's organisations are even more likely to be excluded by compliance burdens, short funding cycles, and lack of core support. A gender-transformative climate-finance approach would reserve funds for women's groups, simplify access, support monitoring capacity, and require reporting on women's control over adaptation assets. Finance should be measured by who controls resources, not only by total disbursement.

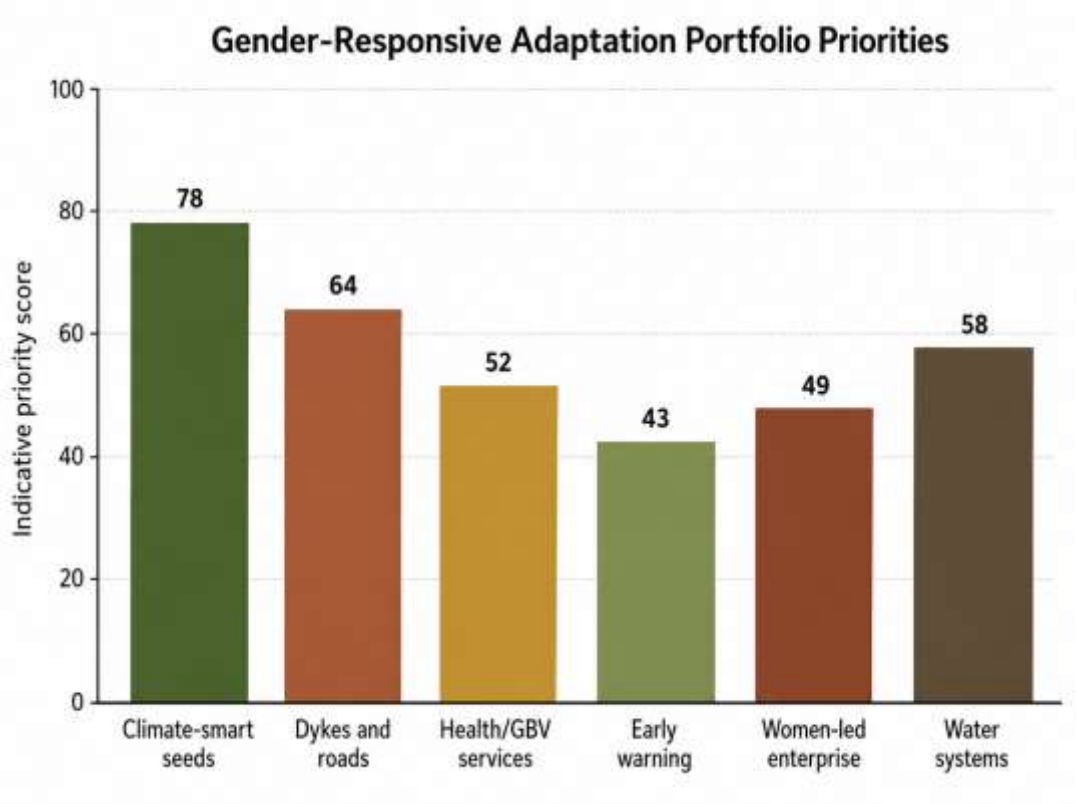

Figure 4. Indicative adaptation priority scores derived from review synthesis. Higher scores indicate actions that combine climate relevance, gender benefit, and implementation urgency.

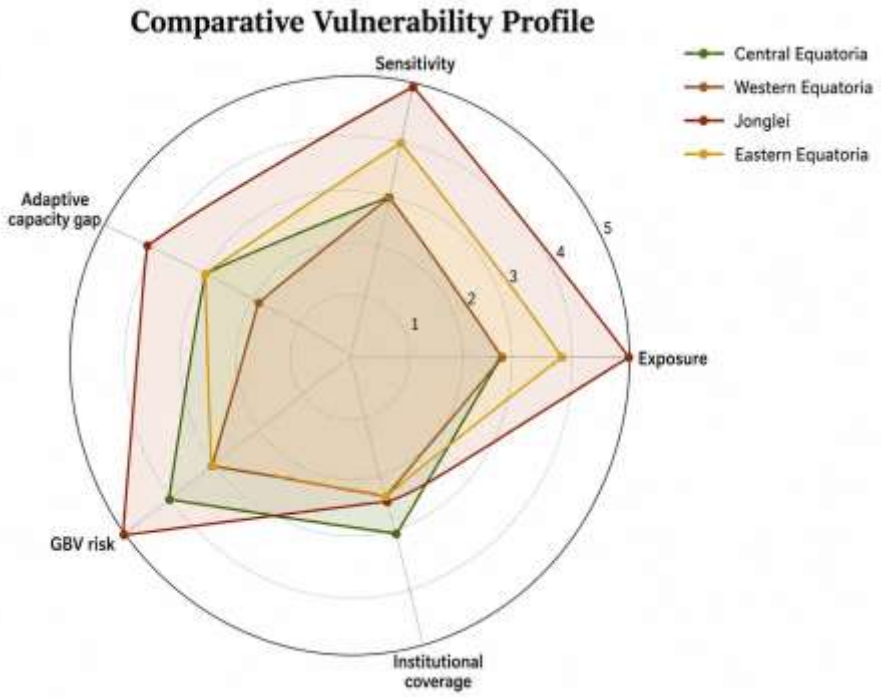

Figure 5. Comparative vulnerability profile for the four states. Scores summarise thematic evidence rather than direct survey measurement.

Table 5. Adaptation options, gender-transformative conditions, and risks

Option	Practical actions	Gender-transformative condition	Implementation risk
Climate-smart agriculture	Seed systems, extension, storage, pest control	Women access inputs directly and control part of income	Elite capture; unpaid labour increase
Flood protection	Dykes, drainage, elevated facilities, road repair	Women shape site selection and safe access routes	Water diversion; unequal protection
Water resilience	Boreholes, solar pumps, water harvesting	Reduced collection time and safer routes	Maintenance failure; fee exclusion
Health and GBV services	Mobile clinics, referral systems, safe spaces	Continuity of SRH and protection during shocks	Underfunded recurrent costs
Early warning	Radio, SMS, local networks, market alerts	Warnings reach women in usable forms	Information without action options
Women's enterprise	Savings, credit, market access, value chains	Income control and diversification	Debt risk; market insecurity

9. State-Specific Synthesis

Central Equatoria requires a different adaptation vocabulary from the one normally used for rural floodplain emergencies. Its climate risks are partly urban, partly peri-urban, and partly rural. In Juba and surrounding settlements, exposure is shaped by drainage channels, road surfaces, informal housing, waste management, heat accumulation, market prices, and water vendors. Climate stress therefore appears as an increase in household expenditure and time poverty as much as crop loss. Women who sell food, brew, wash clothes, manage household water, or care for children experience climate pressure through daily costs and service interruptions. A flooded road may prevent a trader from reaching a market; a heatwave may reduce outdoor work; a water shortage may increase payment to vendors and reduce household hygiene.

The institutional density of Central Equatoria is both an asset and a blind spot. Ministries, universities, UN agencies, embassies, and NGOs are more accessible in and around Juba than in many other parts of the country. This can support policy innovation, training, and monitoring. Yet the presence of institutions does not automatically mean that peri-urban women, internally displaced people, informal workers, or low-income households are heard. A climate adaptation agenda for Central Equatoria should therefore include participatory urban risk mapping, settlement drainage, heat-health alerts, affordable water access, GBV-safe transport planning, and links between women's organisations and municipal authorities. The University of Juba could support applied research on urban climate vulnerability, including time-use effects and informal-market resilience.

Central Equatoria also has a strategic role in national climate governance. If national adaptation plans are designed in the capital without strong feedback from flood-affected, dryland, and agricultural states, they risk becoming administratively elegant but locally weak. Conversely, Central Equatoria can become a coordination hub that translates field evidence into policy, finance proposals, training curricula, and monitoring systems. A gender-responsive national climate dashboard could be hosted or supported by Juba-based institutions while drawing data from county offices, women's groups, health facilities, schools, farmer associations, and humanitarian clusters. This would help close the distance between national policy language and household-level experience.

Western Equatoria is often narrated through agricultural potential, but this review suggests that potential should not be confused with resilience. Fertile land and rainfall can reduce vulnerability only when households have security, inputs, labour, storage, roads, markets, and fair control over income. Women may cultivate, weed, process, and sell produce, but they frequently have weaker land tenure and less access to formal extension. Climate adaptation in Western Equatoria should therefore focus on the entire value chain, not only production. Drought-tolerant or disease-resistant seeds are helpful, but without storage and market access, women farmers may still sell at low prices or lose harvests to pests and spoilage.

A gender-transformative agricultural agenda in Western Equatoria would include women extension agents, demonstration plots scheduled around women's time constraints, small grants for women's processing groups, improved storage, feeder-road maintenance, and transparent market information. It would also recognise that women are not a homogeneous

category. Widows, displaced women, young mothers, women with disabilities, returnees, and women in male-headed households face different constraints. Climate programming should avoid assuming that household-level support automatically reaches women. Registration systems should name women as direct participants and track whether they control the inputs, revenue, or equipment provided.

Western Equatoria also illustrates the importance of conflict-sensitive food-system adaptation. If roads improve and markets expand, new profits can change local power relations. If climate-smart inputs are scarce, distribution may become politicised. If land becomes more valuable, women and displaced households may be pushed aside. Adaptation planning must therefore include land dispute mechanisms, transparent beneficiary criteria, and grievance systems that women can safely use. The goal is not only more production but a fairer and more reliable food system. In this sense, agricultural adaptation is peacebuilding, economic development, and gender justice at the same time.

Jonglei is the clearest case for integrated flood, displacement, and protection adaptation. The state's flood exposure is not merely seasonal inconvenience; repeated inundation can submerge fields, damage shelters, disrupt schools, contaminate water, increase disease risk, and force household movement. When flooding intersects with armed violence, cattle movement, and poor road access, the result is a complex emergency environment. Women and girls may face heightened exposure to GBV during displacement, while pregnant women face dangerous delays in reaching care. Men and boys may face livelihood collapse through livestock disease, pasture loss, and conflict around movement. These gendered risks are connected, not separate.

Adaptation in Jonglei should therefore be mobile, layered, and anticipatory. Fixed infrastructure matters, but it cannot be the only response in areas where water, conflict, and displacement change settlement patterns. Mobile health teams, boat-supported referral, temporary learning spaces, raised storage, pre-positioned supplies, community flood monitors, livestock vaccination, and safe evacuation planning are all relevant. Women's committees should help identify safe routes, priority households, and service gaps. Flood adaptation should also include psychosocial support and protection referral because repeated loss and displacement have cumulative effects on dignity, family relations, and mental health.

The most difficult Jonglei challenge is the interaction between flood adaptation and conflict dynamics. A dyke or road can protect a community, but it can also shift water or movement in ways that others perceive as threatening. Cattle corridors, fishing grounds, dry-season grazing, and administrative boundaries are politically sensitive. Conflict-sensitive adaptation requires negotiation before construction, not only technical design. Women peacebuilders, youth, cattle-camp leaders, chiefs, county authorities, and humanitarian engineers should be part of planning. The question should be: who benefits, who may be harmed, who maintains the asset, and how will disputes be handled when the next flood comes?

Eastern Equatoria highlights heat, water scarcity, and mobility. In dryland and agro-pastoral settings, climate stress can appear as earlier water-point failure, longer livestock routes, crop wilting, higher food prices, and conflict around pasture. Women's burdens increase when water and fuel are farther away, but men's and boys' exposure also rises when livestock

movement becomes longer or more insecure. Girls may be withdrawn from school for water collection or household work. Market women may face reduced demand when households prioritise staples. Adaptation in Eastern Equatoria therefore requires integrated water, livelihood, and peacebuilding measures rather than isolated boreholes.

Water infrastructure in Eastern Equatoria should be designed as social infrastructure. Boreholes, pans, solar pumps, and water-harvesting systems must be linked to maintenance, spare parts, transparent fees, and rules for livestock and household use. Women should be trained and paid as water technicians and committee leaders, not only asked to attend meetings. Where pastoralist mobility crosses administrative or international boundaries, water planning should align with negotiated movement corridors and conflict-resolution mechanisms. Climate adaptation can reduce conflict risk when it clarifies access and expands resources; it can increase conflict risk when it creates scarce, contested assets without governance.

Eastern Equatoria's adaptation agenda should also include heat-health planning. Heat affects agricultural labour, school concentration, maternal health, water needs, and livestock. Yet heat is less visible than flooding because it does not always produce dramatic images. Health facilities, schools, and outdoor work arrangements can adapt through shade, water points, ventilation, heat alerts, adjusted schedules, and community education. Women's groups can help identify who is most at risk: pregnant women, older people, children, people with disabilities, and those working long hours outdoors. Heat adaptation should be integrated into local health and education planning before extreme events force closures or emergencies.

Across all four states, displacement changes the meaning of adaptation. A household may be adapting in one location while losing rights, networks, and assets in another. Returnees from Sudan, internally displaced households, host communities, and pastoralist groups may compete for land, water, labour, and assistance. Women in displaced households often face reduced livelihood options and increased protection risks, but host-community women may also experience additional care and resource burdens. Adaptation planning should therefore treat mobility as normal in the South Sudan context. Services should be portable, records should move with people, and assistance should avoid creating resentment between displaced and host populations.

The state-specific evidence also suggests that local knowledge is indispensable. Hydrological models, satellite data, and national plans are valuable, but they need to be interpreted with people who know seasonal routes, sacred sites, cattle paths, unsafe areas, flood memories, market cycles, and gendered labour patterns. Women may know which water points fail first or where girls feel unsafe. Cattle keepers may know migration routes that formal maps miss. Traders may know when roads become impassable or prices spike. Local knowledge should be documented respectfully and used alongside technical data rather than treated as anecdotal.

A final cross-state theme is institutional trust. Early warning, evacuation advice, agricultural extension, GBV referral, and water governance depend on whether people trust the messenger. In conflict-affected settings, trust is shaped by ethnicity, politics, past exclusion, language, gender, and perceived fairness. Women may not trust formal reporting systems if

confidentiality is weak or if perpetrators are powerful. Farmers may ignore extension advice if earlier promises failed. Adaptation programming should therefore invest in relationships, not only activities. Consistent presence, transparent selection, feedback loops, and visible correction of mistakes are practical adaptation tools.

10. Research, Monitoring, and Evidence Gaps

The most urgent research gap is the shortage of longitudinal, sex-disaggregated, state-level evidence. Many reports provide national figures or short emergency snapshots, but adaptation requires tracking change over seasons. For example, it is not enough to know that a flood displaced households; policymakers need to know whether girls returned to school, whether women recovered income, whether pregnant women reached care, whether GBV referrals functioned, whether seed distributions produced harvests, and whether households accumulated debt. A seasonal panel approach in selected counties could generate much stronger evidence for adaptation planning.

A second gap concerns adaptation effectiveness. Many documents describe what agencies plan to do or what communities need, but fewer assess which interventions work, for whom, under what conditions, and at what cost. Dykes, seeds, boreholes, cash support, mobile clinics, and early-warning systems should be evaluated not only by outputs but by outcomes. Did the intervention reduce time poverty? Did women control resources? Did it reduce harmful coping strategies? Did it lower school dropout? Did it remain functional after one rainy season? Implementation research can answer these questions without waiting for perfect conditions.

A third gap is urban climate vulnerability. South Sudan climate literature often focuses on rural livelihoods and flood emergencies, but urban and peri-urban risk is growing. Juba's households experience climate stress through water markets, heat, sanitation, drainage, disease, transport, food prices, and informal work. Urban women may not own farms, but they still experience climate shocks through unpaid care, market volatility, and settlement insecurity. Research on urban heat, drainage, informal settlements, and gendered livelihoods would help Central Equatoria plan more effectively and would support other growing towns.

A fourth gap is climate finance tracking. South Sudan needs adaptation investment, but the gender distribution of climate finance is difficult to see. Future studies should track how much adaptation funding reaches state and county levels, how much reaches local civil-society organisations, and how much is controlled by women's groups. Budgets should be analysed for gender markers, but markers alone are not enough. Researchers should examine procurement, payment delays, reporting burdens, and whether local groups can access funds without being overwhelmed by compliance systems designed for larger organisations.

A fifth gap is the relationship between customary authority, statutory governance, and gender-transformative adaptation. Land, water, cattle movement, marriage, inheritance, and dispute resolution are shaped by plural legal and customary systems. Adaptation programmes often need these authorities to function, yet those same systems may exclude women or young people. Research should examine how women negotiate authority in climate committees, peace forums, farmer groups, and water bodies. The aim should not be to

romanticise local institutions or dismiss them, but to understand how they can change in ways that support dignity and resilience.

Monitoring should use a small set of practical indicators. Suggested core indicators include: percentage of women receiving and understanding early warnings; average time spent collecting water by sex and age; percentage of women with direct access to climate-smart inputs; number of functioning GBV referral points during climate shocks; girls' attendance after floods or droughts; maternal-health referral delays during extreme weather; proportion of adaptation committees where women hold decision roles; and number of climate-finance grants reaching local women's organisations. These indicators are feasible, policy-relevant, and connected to the pathways identified in this review.

The evidence agenda should be locally owned. International agencies have resources and technical capacity, but South Sudanese universities, researchers, women's organisations, county officials, and community structures should shape questions and interpret findings. External evidence systems can unintentionally extract data without building local capacity. A better model would fund joint research teams, train county-level enumerators, support ethical data collection, and return findings in usable formats. Evidence should circulate back to communities through local languages, radio discussions, policy briefs, and planning meetings. Research that does not return to affected people is incomplete.

11. Policy Framework for Gender-Transformative Adaptation

The proposed framework has five pillars: protect, provide, participate, transform, and learn. Protect means reducing GBV, SRH, health, mobility, and displacement risks during climate shocks. Provide means ensuring that households and communities have water, food-system support, roads, clinics, schools, climate information, and livelihood assets. Participate means women, youth, displaced people, pastoralists, and people with disabilities influence adaptation decisions. Transform means changing unequal access to land, finance, information, and authority. Learn means building monitoring systems that track outcomes and adjust programmes when evidence shows exclusion or harm.

The framework should be applied through state adaptation compacts. Each compact would identify the dominant climate hazards, gendered pathways, priority investments, responsible institutions, finance sources, and monitoring indicators for one state. For Jonglei, the compact would prioritise flood-displacement-protection systems. For Eastern Equatoria, water, heat, and mobility governance would be central. For Western Equatoria, agricultural value chains and market resilience would lead. For Central Equatoria, urban and peri-urban planning would be foregrounded. A compact approach keeps national coherence while allowing local differentiation.

A practical financing model would combine large infrastructure funds with small local adaptation grants. Large funds are needed for roads, dykes, water systems, and health infrastructure. Small grants are needed for women's savings groups, seed multiplication, local early-warning networks, safe-space support, school continuity, and market initiatives. The two scales should reinforce each other. For example, a road investment should include funds for women's market access and protection monitoring. A water project should include women

technician training and maintenance finance. A health facility upgrade should include GBV referral and SRH continuity.

Accountability is the heart of the framework. Adaptation should be judged by whether it reduces risk for those most exposed and least resourced. Community scorecards, women's feedback groups, public budget displays, complaint mechanisms, and participatory monitoring can make adaptation more accountable. Indicators should be reviewed at state level and reported nationally. The process should be simple enough to work in low-capacity settings but strong enough to reveal exclusion. Where projects increase women's labour, fail to reach displaced households, or create conflict over resources, programmes should be corrected rather than merely completed.

12. Limitations, Submission Fit, and Practical Use

This review has several limitations that should be made explicit before submission. First, the article relies on a mixture of peer-reviewed and grey literature. This is methodologically defensible for a scoping review in a crisis-affected setting, but it means that evidence quality varies. Some humanitarian sources are timely and operationally detailed, while others are brief, donor-facing, or shaped by access constraints. Second, the review does not include primary interviews with women, local authorities, health workers, or adaptation practitioners in the four states. Fieldwork would strengthen the analysis, especially around local perceptions, informal adaptation, and sensitive protection issues. Third, some figures use interpretive scoring to summarise evidence patterns. These scores are transparent synthesis tools, not statistical measurements.

A fourth limitation is the uneven geography of available evidence. Jonglei receives more attention because flooding and displacement have generated substantial humanitarian reporting. Central Equatoria is visible because it contains Juba and national institutions. Western Equatoria and Eastern Equatoria are sometimes less detailed in national documents despite their importance for agriculture, water, pastoralist mobility, and cross-border livelihoods. This unevenness should be treated as a finding rather than only a weakness. It shows where future research should be directed and where policymakers may be making decisions with insufficient local evidence. The review therefore recommends state-level evidence compacts rather than a single national climate narrative.

For journal submission, the strongest fit would be a disaster-risk, climate adaptation, African studies, gender and development, or humanitarian policy journal. Because the user asked to select the best journal from a list but no list was supplied, this draft uses Jàmbá: Journal of Disaster Risk Studies as a provisional template because it commonly publishes disaster-risk, vulnerability, resilience, and African-context scholarship. If a different list is provided, the title page, reference style, abstract length, heading levels, and declaration format should be adjusted. The current draft already includes a DOI field, correspondence email, ORCID placeholder, declarations, tables, figures, equations, and a structured scoping-review format, which should make adaptation to another journal relatively straightforward.

The email and ORCID issue should be handled according to the target journal. A corresponding author's email address is normally necessary because editors need a formal

route for communication, proofs, and post-publication queries. ORCID is not always mandatory, but it is strongly recommended because it distinguishes authors with similar names, connects publications across platforms, and improves indexing. If the author does not yet have an ORCID, she can register for free and insert it before submission. If the journal uses double-anonymous review, the title page may be uploaded separately and identifying details may be removed from the manuscript file during initial review. The final published version can still include email, affiliation, and ORCID.

Practically, the article can be used in three ways. As a journal manuscript, it offers a coherent evidence synthesis and a gender-transformative adaptation framework. As a policy brief source, its tables and figures can be shortened into recommendations for ministries, UN agencies, NGOs, and donors. As a research agenda, it identifies specific state-level evidence gaps suitable for graduate research at the University of Juba and partner institutions. The strongest next step before submission would be verification of all source details, insertion of any author's ORCID, confirmation of the selected journal's reference style, and, if feasible, consultation with South Sudanese gender, climate, and humanitarian practitioners to validate the state-level synthesis.

13. Discussion

The review shows that climate adaptation in South Sudan cannot be separated from peacebuilding, humanitarian response, food systems, health, and gender justice. The same flood that destroys crops may displace families, increase GBV risk, interrupt antenatal care, close schools, spread disease, and undermine market access. The same dry spell that reduces water availability may increase women's walking time, intensify pastoralist movement, and heighten local disputes. Adaptation designed as a narrow technical response will miss these connections. A gendered climate-security approach is therefore not an optional theoretical addition; it is necessary for practical effectiveness.

The evidence also challenges a simple vulnerability narrative. Women and girls face disproportionate burdens, but they are not passive victims. They manage seeds, food stocks, household water, informal credit, child nutrition, local warnings, and community care networks. They often know which roads become unsafe, which water points fail first, which households are under stress, and which coping strategies are becoming harmful. Treating women only as vulnerable beneficiaries wastes this knowledge. Gender-transformative adaptation should build from women's existing expertise while changing the conditions that make that expertise unpaid, unsafe, and under-recognised.

State comparison reveals that adaptation priorities must be locally differentiated. Jonglei requires intensive flood, displacement, protection, and mobile-service strategies. Eastern Equatoria requires water, heat, pastoralist mobility, and natural-resource governance strategies. Western Equatoria requires agricultural value-chain, road, storage, and market resilience. Central Equatoria requires urban climate planning, drainage, informal-settlement services, heat management, and institutional coordination. A national policy can set standards, but implementation should be state-specific. The four states also need cross-state learning because flood protection, dryland water management, urban service delivery, and agricultural value chains each contain lessons for the others.

The review identifies a persistent measurement gap. Many documents mention women, girls, or vulnerable groups, but fewer provide sex- and age-disaggregated indicators that can guide adaptation budgets. Even fewer measure women's control over assets, time savings, safety, or decision influence. Counting women reached by a project is not enough. A project can reach women while increasing their labour or leaving decision power unchanged. Better indicators would include hours saved in water collection, proportion of women controlling climate-smart inputs, girls returning to school after floods, functioning GBV referrals during displacement, and women's influence over local adaptation budgets.

Another gap concerns the relationship between humanitarian action and long-term adaptation. Humanitarian agencies provide essential services during floods, displacement, and food crises, but repeated emergency response can become a substitute for structural investment. South Sudan needs both: immediate humanitarian support and long-term resilience systems. For example, food assistance can prevent acute hunger, but agricultural adaptation, roads, storage, peacebuilding, and market systems are needed to reduce repeated dependence. Similarly, emergency GBV services are lifesaving, but prevention requires safe infrastructure, gender norms work, economic support, and accountable institutions.

The policy opportunity lies in integration. South Sudan's NDC, food-security systems, disaster-risk planning, gender policy, health planning, and peacebuilding work should not proceed in parallel. A district or state adaptation plan should include an evidence dashboard, gender and protection analysis, climate-risk map, livelihood calendar, health-service continuity plan, and conflict-sensitivity assessment. Universities, including the University of Juba, can support this integration through research, policy translation, training, and locally grounded evidence generation. Academic institutions can also help move climate knowledge beyond short donor cycles.

There are limitations. The review depends heavily on grey literature because peer-reviewed state-specific research remains limited. Humanitarian data may undercount remote or inaccessible populations. The 2026 evidence base is still emerging, and some current reports may be updated after this article is finalised. The scoring in figures is interpretive and intended for synthesis, not statistical inference. Despite these limitations, the review provides a structured map of the evidence and a practical agenda for research, programming, and policy. Its strongest contribution is the integration of gender, climate, conflict, health, and livelihoods in one comparative framework.

14. Recommendations

First, adaptation planning should require gender and protection analysis before projects are approved. This analysis should examine who controls land, who collects water, who uses roads, who receives warnings, who decides livestock movement, who can access clinics, and who faces violence during displacement. These questions should be budget questions, not only consultation questions. The adaptation equity index proposed in this article can be used as a simple screening tool for project design.

Second, climate-smart agriculture should be delivered through women-accessible systems. Seed fairs, extension visits, demonstration plots, storage support, and market programmes

should include women as registered recipients and decision-makers. Agricultural adaptation in Western Equatoria and Central Equatoria should prioritise post-harvest systems and market access, while Jonglei and Eastern Equatoria require stronger links to flood recovery, animal health, water systems, and mobility planning.

Third, flood and water infrastructure should be designed with conflict sensitivity and women's safety. Dykes, roads, drainage, boreholes, and solar pumps should be mapped against settlement patterns, collection routes, grazing movement, school access, and clinic access. Women's groups should participate in location decisions and maintenance governance. Infrastructure should be monitored for unintended harm, including water diversion, exclusion of poorer households, and conflict over fees or access.

Fourth, SRH and GBV services should be included in climate adaptation budgets. Mobile clinics, referral transport, emergency reproductive-health kits, safe spaces, psychosocial support, and confidential reporting pathways are climate resilience investments in flood- and displacement-affected settings. This is especially urgent in Jonglei and flood-prone parts of Central Equatoria, but it is relevant across all four states.

Fifth, early warning should be gender-responsive. Warnings must reach women and girls through trusted channels and provide actionable guidance. A warning that says flood risk is rising is incomplete if households have no safe route, no transport, no shelter, or no protection plan. Community climate information should be linked to local preparedness funds, school plans, health outreach, livestock movement agreements, and market information.

Sixth, climate finance should reach local institutions and women's organisations. International finance should support national systems, but it should also avoid becoming trapped at central levels. Small grants, flexible funds, and technical support can help local women's groups lead adaptation work. Reporting should track not only money spent but who controlled the money, what changed, and whether unpaid care or protection risks were reduced.

Seventh, research should move from general vulnerability statements to comparative, state-level, sex-disaggregated evidence. The University of Juba and partners could establish a climate-gender observatory that collects seasonal data on hazards, livelihoods, care burdens, school continuity, SRH access, GBV referral functionality, and adaptation outcomes. Such a platform would help policymakers move from reactive crisis response to anticipatory adaptation.

15. Conclusion

Climate change impacts in South Sudan are gendered because they pass through unequal systems of labour, assets, mobility, safety, health access, and decision-making. Between 2021 and 2026, the evidence points to recurrent floods, heat and water stress, acute food insecurity, displacement, and fragile services as major risk pathways in Central Equatoria, Western Equatoria, Jonglei, and Eastern Equatoria. Jonglei requires urgent flood-displacement-protection adaptation; Eastern Equatoria requires water, heat, and mobility governance; Western Equatoria requires agricultural and market resilience; and Central Equatoria requires

urban and peri-urban climate planning linked to national institutions. Women and girls face disproportionate burdens, but they are also central adaptation agents. The strongest policy direction is therefore gender-transformative adaptation: climate action that reduces unpaid care, protects health and safety, expands women's control over resources, strengthens local institutions, and recognises women's knowledge as part of the country's resilience infrastructure. Correcting institutional names, including correspondence details, and providing transparent DOI information are small but important parts of scholarly credibility. The larger task is to ensure that adaptation scholarship and policy in South Sudan are as attentive to dignity, agency, and justice as they are to hazards and infrastructure.

Declarations

Correspondence, email, and ORCID: Most journals require a corresponding author's email address. ORCID is strongly recommended and increasingly required, but if the author does not have one, it can be added later after registration at https://orcid.org. The email may be included on the title page or hidden in anonymised peer review depending on the journal's submission system.

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Author contribution: Elia Lona James conceptualised the review topic, institutional framing, and manuscript direction. The final author should verify all citations, statistics, and journal requirements before submission.

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