Yemen's climate fragility trap: Trends, consequences, and pathways for policy action

Sanjana Srivastav and Numair Liaqat

- Yemen has faced severe climate-induced shocks, including floods, droughts, and cyclones. These have led to significant infrastructure damage, food insecurity, displacement, and environmental degradation, worsening the country's humanitarian crisis.
- The ongoing conflict has further strained Yemen's economy, leading to a 50% GDP contraction between 2011-2022, high inflation, unemployment, and dependence on external financing. These are all compounded by a divided economic landscape due to political fragmentation.
- Climate change acts as a stress multiplier in Yemen, exacerbating vulnerabilities in rural areas reliant on agriculture and water resources, fuelling conflicts over scarce natural resources, and contributing to further displacement and social tensions.
- Addressing Yemen's climate-fragility trap requires a comprehensive approach, including short-term recovery policies (i.e., fiscal buffers, social safety nets, and emergency response) and long-term resilience strategies (i.e., climate-smart agriculture, water diversification, and governance strengthening), supported by international cooperation and targeted interventions.

POLICY BRIEF YEM-25055

APRIL 2025

This project was funded by the State Fragility initiative

theigc.org/sfi

DIRECTED BY LSE UNIVERSITY OF OXFORD

FUNDED BY UKaid from the British people

Overview

Yemen demonstrates the complex and compounding challenges faced by fragile states on the frontlines of climate change. The intersection of protracted conflict and intensifying climate-induced shocks has deepened vulnerabilities, disrupted livelihoods, and strained critical infrastructure. This convergence is not only accelerating humanitarian needs but also locking the country into a vicious cycle where fragility undermines climate resilience, and climate shocks in turn fuel further instability.

Despite growing recognition of the climate-conflict nexus, Yemen exemplifies how these dynamics converge in ways that undermine both humanitarian response and development gains. Yet, few policy frameworks fully capture this intersection

To break this cycle, Yemen requires both immediate recovery measures and long-term resilience strategies. This policy brief outlines a two-pronged approach that addresses urgent recovery needs while building a foundation for long-term climate adaptation and economic stability.

Introduction

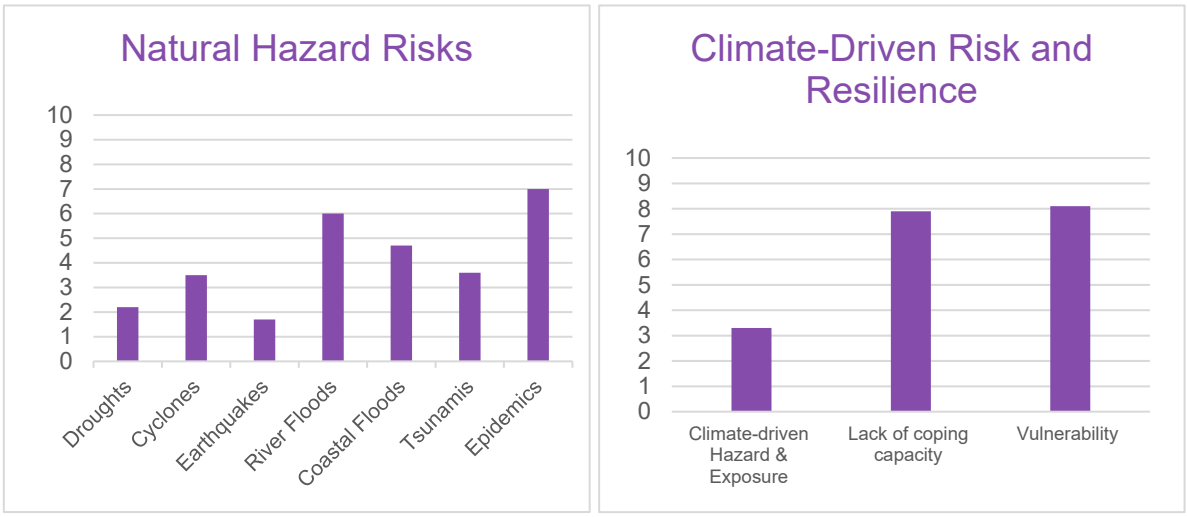
In recent years, Yemen has experienced a multitude of climate-induced shocks, including flash floods, droughts, and unprecedented cyclones (see Figure 1) (Al-Mowafak, 2021). These events have severely affected the population, exacerbating an already fragile humanitarian situation and compounding Yemen's vulnerabilities.[1] These environmental shocks have damaged critical infrastructure, limited access to essential services, increased food insecurity, disrupted livelihoods, and contributed to the displacement of over four million people,[2] making it the world's fourth-largest internal displacement crisis (UN, 2021).

As for climate variability (8.1/10), Yemen ranks 171st out of 181 countries in the Notre Dame Global Adaptation Initiative (ND-Gain) Index and is the 22nd most vulnerable and the 12th least ready country to adapt to climate change (YFCA, 2023). In 2020 alone, at least 13 governorates were impacted by adverse weather, affecting over 62,500 families (YFCA, 2023). Moreover, the already frail food security situation is further threatened by recurrent drought and climate change, with some five million people on the brink of famine (UN, 2021).

[1] Vulnerability is the degree to which a system is at risk from climate impacts, defined as exposure (degree of hazard risk) + sensitivity (susceptibility to damage) − adaptive capacity (ability to cope and respond).

[2] Recent research by CARPO found that nearly half a million people were directly affected by the 2020 torrential rains and the resultant flooding, many of whom were already displaced due to the conflict.

FIGURE 1: Climate change indicators for Yemen



Sources: IMF Climate Change Dashboard (IMF ClimateData, 2023) and The European Commission Disaster Risk Management Knowledge Centre (2025).

The ongoing conflict has also led to a surge in environmentally harmful activities, such as poaching and illegal logging (Al-Mowafak, 2021). Fuel shortages, resulting from a blockade of Houthi-controlled areas and restrictions on imports, have contributed to escalating deforestation, with more than 860,000 trees being cut down annually (Abdullah, 2021). This not only contributes to severe environmental degradation but also exacerbates ongoing issues of food insecurity, disrupts critical ecosystems, and depletes arable land and sources of safe drinking water.

Yemen's fragility trap

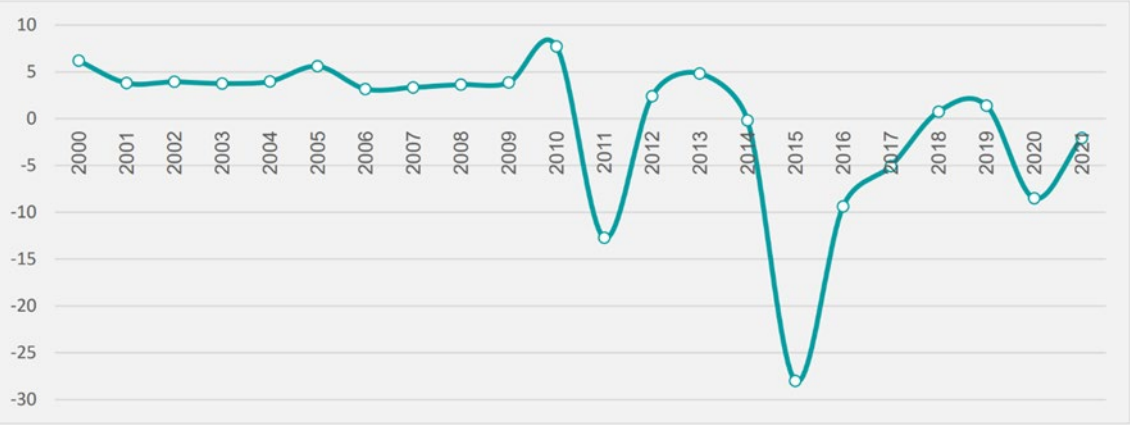
Yemen has suffered chronic structural challenges alongside complex economic, political, and security issues that have played a pivotal role in both the onset and perpetuation of the ongoing conflict. Although the country was strained even before the outbreak of war in late 2014, the conflict resulted in a contraction of real GDP by approximately 50% between 2011-2022 (see Figure 2). Critical infrastructure, including homes, schools and hospitals, has suffered extensive damage, with at least one-third of water, sanitation, hygiene, and transport infrastructure being destroyed (World Bank, 2020). This has undermined both economic and productivity indicators, with economic output plummeting by approximately 28% in the first year of war alone (Al-Alkhali, 2021).

The **economic turmoil** in Yemen is characterised by high inflation (29.1% in 2022), stagnant wages, high unemployment, current account deficit, exchange rate volatility, high debt burdens, and heavy dependency on external financing (ESCWA, 2021; OECD, 2022). Additionally, the expiration of the UN-sponsored

truce and the Houthi-imposed blockade on oil production and exports have further exacerbated fiscal pressures, prompting expenditure cuts that undermine essential public services and long-term economic growth (World Bank, 2023).

These challenges are compounded by a high population growth rate, poverty, weak governance, and deteriorating institutional capacity, which have led to insufficient coping mechanisms to deal with these economic shocks and mounting pressures.

FIGURE 2: Real GDP growth rate in Yemen during the period 2000-2021 (%)



Source: Ministry of Planning and International Cooperation (2023) report

The future of Yemen's economy hinges closely on resolving ongoing **political** disputes that have fragmented its economic landscape. Conflict between the Houthis and the Internationally Recognised Government (IRG) has effectively divided Yemen into two distinct monetary and economic zones (Al-Akhali, 2021). This division is characterised by the usage of different banknotes and is marked by disputes over imports and rising fees for transfer between areas of control, often resulting in double taxation – with both authorities imposing charges on the same goods or transactions.

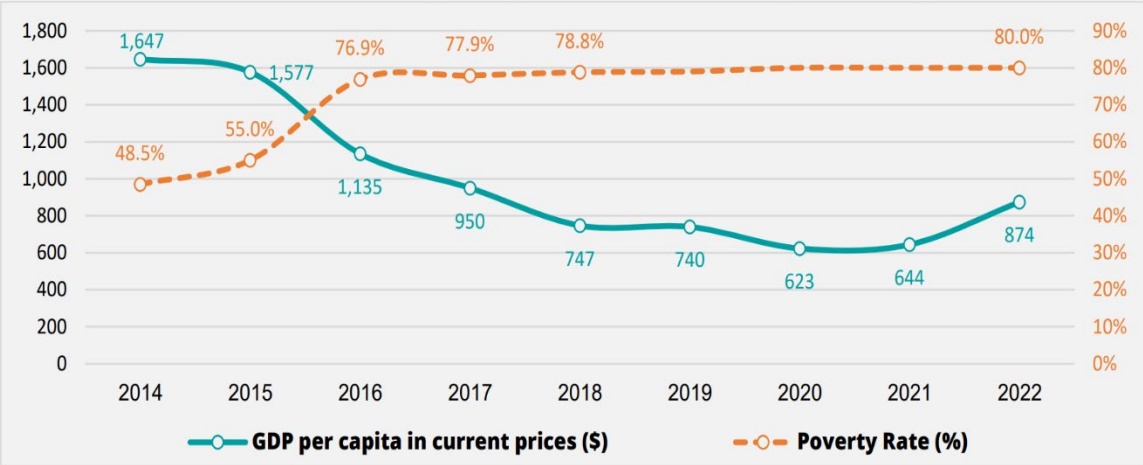
Additionally, the prevalence of clientelism, high perceptions of corruption, and restriction of political rights further aggravates political and social tensions within the country (OECD, 2022). The political fragmentation and ongoing conflict have suppressed judicial and legislative constraints on executive power, further weakening the country's ability to effectivity coordinate and cope with these challenges.

Socially, 80% of the population is below the poverty line (see Figure 3), 4.3 million people have been displaced due to the ongoing war, and 2.2 million children suffer from acute malnutrition (MOPIC, 2023).

Yemen's unsustainable coping mechanisms

Livelihoods dependent on agriculture and fishing are deteriorating, displacing millions, and driving reliance on unsustainable coping mechanisms such as asset sales, reduced food intake and early child marriages (UNHCR, 2024). The fight over access to water and land is heightening pre-existing tensions, while the collapse of environmental governance is enabling environmentally harmful practices to thrive.

FIGURE 3: Per capita GDP at current price in USD and % of population below the national poverty line between 2014-2022



Source: Ministry of Planning and International Cooperation (2023) report

Climate change as a stress multiplier in Yemen

According to the World Bank Yemen Country Climate and Development report, Yemen's annual GDP is projected to decline by an average of 3.9% by 2040, characterised by a scenario that includes increased temperatures and longer dry periods (World Bank, 2024). These losses are primarily driven by reductions in crop production and fisheries, limitations on labour productivity, and the deterioration of health and connectivity infrastructure.

Climate change acts as a potent stress multiplier in fragile contexts such as Yemen, amplifying existing vulnerabilities tied to weak socio-economic development and limited adaptive and governance capacity. This is quite evident in rural areas that depend heavily on climate-sensitive resources such as agriculture, fisheries, and forests. For example, the 75% of Yemen's rural population engaged in farming or pastoralism could face a significant threat to their livelihoods due to deteriorating agricultural productivity (from droughts),

increased rainfall variability, longer and hotter dry periods and damage from climate-induced disasters (World Bank, 2024). The downturn in livelihoods is expected to push poverty levels to higher levels, which, in turn, could escalate pre-existing social grievances and fuel further unrest (Small Arms Survey, 2010).

Additionally, climate-induced events like flash floods have spurred new waves of internal displacement, which have resulted in people moving to areas where natural resources are already under stress (Al-Akwa & Zumbrägel, 2021). For example, water shortages are driving competition for crucial resources, exemplified by a 13-year fight over water access between two villages in Taiz (Al-Mowafak, 2021). According to researchers from Sana'a University, 70-80% of disputes in rural Yemen are related to water (UNDP, 2022). It has been estimated that one-third of the cases taken to criminal courts in Yemen focus on water-related conflict deaths (UNDP, 2022). Similarly, longstanding grievances over land distribution remain a major source of conflict in southern Yemen (UN-Habitat, 2022). Thus, climate change-induced shocks can push individuals to compete for scarce natural resources, which can escalate existing social and political tensions and fuel further conflict.

Pathways for policy action

The consequences of fragility in Yemen have hindered the ability of those most vulnerable to climate change to adapt effectively, thereby trapping them in a vicious cycle (Climate Diplomacy, 2020). Thus, addressing the "climate-fragility trap" through effective policy action requires a comprehensive approach that combines immediate response to climate shocks with long-term strategies to build climate resilience over time (IMF, 2023).

In Yemen's context, such policies must be conflict-sensitive, locally grounded, and flexible enough to adapt to rapidly shifting security and governance dynamics.

Since conflict often undermines fragile states' capacity to manage climate risks effectively, implementing such policies will require sizeable and sustained international support to overcome credit, resource, and capacity constraints. This support may include grants, concessional financing, and capacity development, among other measures.

Short-term recovery policies to address immediate shocks

1. Building fiscal buffers and international reserves

Empirical research indicates that countries with larger fiscal buffers (i.e., higher fiscal balance and lower public debt) tend to recover more rapidly from extreme weather events, with evidence suggesting that such buffers are more important for fragile and conflict-affected situations (FCS) than non-FCS (IMF, 2023). This is because larger fiscal buffers provide countries with greater scope and flexibility in responding effectively to disasters through cash transfers and reconstruction spending, for example (Noy, 2009; Bayoumi et al., 2021). Thus, to enhance immediate response capabilities to climate shocks, it is necessary to increase domestic revenues, reduce public debt and deficits, and maintain higher international reserves. Yemen already has a huge reliance on foreign aid, and its level of public debt has also become a significant concern. Public debt in Yemen averaged 72.8% of GDP in the decade to 2022, well above the Middle East & North Africa average of 40.7% of GDP (Focus Economics, 2022).

Given Yemen's fiscal challenges and divided governance, building fiscal buffers requires leveraging external support and improving revenue collection in stable regions. A practical approach would be to:

- **Partner with international financial institutions** (IFIs) like the World Bank and the IMF to secure concessional loans and debt relief programs (IMF, 2019). International creditors' support is essential to alleviating or restructuring the current debt through negotiations in the Paris Club. This would enable the Government of Yemen to redirect funds originally allocated for debt payments in high-priority areas that ensure significant impact and high contribution to reduce the country's fragility.
- **Localise revenue collection** in relatively stable regions under government control by enhancing tax collection systems at local levels (van den Boogaard et al., 2018). This could involve partnering with community leaders to ensure compliance and transparency, minimising opportunities for corruption.
- **Resume oil exports securely**: Prioritise the restoration of oil production and exports, ensuring security around key infrastructure to regain a critical revenue source that once contributed to over 70% of government revenue prior to the war. Collaborate with international partners to safeguard and regulate the sector.
- **Allocate revenues to climate adaptation**: Direct a portion of oil and tax revenues toward climate-smart agriculture, water conservation, and disaster preparedness to ensure long-term

resilience while gradually diversifying the economy beyond fossil fuels.

2. Strengthening social safety nets

Establishing a robust social safety net is critical in FCS, which typically suffer from high levels of informality and poverty rates (IMF, 2023). Strengthening social safety nets and leveraging insurance schemes are key to financing recovery and building resilience to climate shocks (Holmemo et al., 2023). By expanding support to households impacted by events such as droughts and floods, well-targeted safety nets can play a pivotal role, particularly when deployed early or in anticipation of disasters. In the absence of such safety nets, marginalised groups are left vulnerable without the means to anticipate or adapt to climate change, potentially escalating resentment and conflict.

Social safety nets can be more effective if designed to operate within informal systems already present in Yemen. This could involve:

- **Utilising mobile-based cash transfer systems** as used in other fragile contexts (for example, Somalia) to provide aid directly to affected communities, bypassing bureaucratic inefficiencies. The World Food Programme (WFP) has previously piloted similar initiatives in Ethiopia, Sierra Leone, Jordan, Kenya, Somalia, Lebanon and also in Yemen (WFP, 2021).
- **Targeted assistance for rural communities** dependent on agriculture and fishing, with conditional cash transfers tied to sustainable resource use practices (such as water conservation).
- **Expanding community-driven social safety nets** through local NGOs and tribal networks, building on their local knowledge and trust (Harvey, P. 2009). These initiatives could focus on providing food vouchers, health services, and emergency aid in times of crisis.

3. Strengthening institutional capacity for emergency response

A recent study by UNDP found that climate change places additional strain on fragile states' institutional capacity, weakening their ability to respond effectively to internal and external shocks (Brookings Institution, 2022). Thus, it is critical to enhance institutional capacity for robust emergency response and counteract the emergence of conditions favourable to violent extremist groups (UNDP, 2020a). This involves integrating climate adaptation measures into existing institutional frameworks and ensuring alignment with broader conflict prevention and resolution goals.

Yemen's institutional weaknesses require a bottom-up approach to emergency response, focusing on building capacity at local levels. Practical steps include:

- **Decentralising emergency response** by training local governments and communities to lead early warning and disaster preparedness systems. Such mechanisms have been effective in countries like Sudan (UNDP, 2020b). For example, training could be provided to local councils and civil defence forces to manage localised climate-induced disasters.
- **Leveraging international partnerships** with organisations like the UNDP and OCHA to deliver climate adaptation training to local agencies. Case studies from South Sudan and Nigeria illustrate the effectiveness of international partnerships in providing climate adaptation and emergency response training to local governments (UNOCHA, 2019). These programs should emphasise conflict-sensitive climate responses to avoid exacerbating existing tensions.
- **Developing rapid-response teams** within Yemeni Red Crescent and local NGOs to manage climate-related disasters in areas with minimal state presence.

Long-term resilience and adaptation policies

1. Integrating climate resilience into peace and security efforts

Climate resilience must become an integral component of peace and security initiatives to effectively address underlying threats contributing to social tensions and conflict. This could involve a comprehensive assessment of the climate, peace, and security nexus to better understand their interconnectedness and tailoring policies to simultaneously bolster climate resilience and mitigate potential conflict triggers. Additionally, linking early warning systems with conflict prevention is an effective strategy to address the interconnected nature of climate-related risks and conflict dynamics, facilitating a more holistic and anticipatory response to emerging threats (UNFCCC, 2014).

Building peace and resilience in conflict zones requires integrating climate adaptation into local peacebuilding efforts:

- **Conduct local climate-peace assessments** in conflict hotspots where competition over natural resources fuels tensions (for example, Taiz). These assessments would inform targeted peacebuilding and conflict resolution strategies, which also address climate impacts like water scarcity. Stockholm International Peace Research Institute (SIPRI) research supports this, showing that

localised assessments can help mitigate resource-based tensions (SIPRI, 2022).

- **Mediation of resource-based conflicts** through local peace committees. International actors could fund and train these committees to address disputes over water and land use, while introducing conflict-sensitive climate adaptation techniques like sustainable irrigation. In Kenya and Ethiopia, local peace committees have been used to mediate water conflicts, reducing violence while promoting sustainable resource management (USAID, 2023).
- **Regional resource-sharing agreements** could be facilitated with international support to mitigate conflicts over scarce resources. For example, inter-village water-sharing agreements or joint land-use practices could be mediated by local governance structures with technical assistance from international donors.

2. Developing climate-smart agriculture

As highlighted in earlier sections, climate-related disruptions in the agricultural sector can quickly affect food security, which has the potential to fuel further conflict. As such, shifting towards climate-smart agricultural practices such as improved irrigation, drainage systems, water management, and land use can enhance resilience to climate shocks (FAO, 2021b). Other practices could include enabling farmers to access stress-tolerant seeds and funding research to develop more drought-resistant crops to help withstand adverse climate conditions (IMF, 2023). Adopting climate-smart agriculture is an effective strategy to reduce farmers' vulnerability to climate change, boosting their agricultural yields, and increasing food security.

Climate-smart agriculture can be introduced gradually, starting in relatively secure areas, and scaling up as conditions allow:

- **Pilot programs in secure regions** (such as Hadhramaut or Marib) could demonstrate the benefits of climate-smart practices like drip irrigation, drought-resistant crops, and solar-powered water pumps. Successful pilots could be expanded across the country. Northern Uganda has seen the benefits of such pilots (World Bank, 2019).
- **Strengthening agricultural and fisheries finance for climate resilience**: Given the limited presence of agricultural cooperatives in Yemen, efforts should focus on supporting fisheries cooperatives, which are more active across coastal governorates. Donors should channel financial support through specialised banks, such as the Agricultural Cooperative Credit Bank (CACBANK) and microfinance institutions, to provide tailored financial products and

loans for farmers and fishermen. Additionally, strengthening the Fund for the Promotion of Agricultural and Fish Production through increased domestic revenues and international support will enhance access to credit, improve assets, and boost production in both sectors (FAO, 2022).

3. Diversifying water sources

As illustrated in the case studies above, climate change has been threatening the availability and predictability of water resources in FCS (De Coning et al., 2020). The resulting water scarcity has heightened competition over scarce natural resources, intensified tensions, and even triggered mass migration. As a result, it is important for countries to consider investments in diversifying their water sources, including both surface and underground sources of water (Brookings Institution, 2022). In areas with heightened vulnerability, there may be a need to allocate funds for the establishment of dams and aquifers, along with the restoration of existing water reservoirs (Cap-Net et al., 2018). This could be achieved through support from NGOs that promote community-driven water resource management and are able to engage with local communities, even in remote areas.

Water scarcity in Yemen can be addressed by combining traditional and modern solutions:

- **Promote solar water pumping through affordable financing and incentives.** Establish low-interest credit schemes, microfinance options, and subsidies to replace expensive commercial loans, encourage private sector investment through tax incentives and import duty reductions, and integrate solar water pumping into national water and energy policies. Support adoption through pilot projects, technical training for farmers, and public awareness campaigns to ensure long-term sustainability.
- **Revive water management systems** (like rainwater harvesting and terrace farming).The use of traditional water systems such as terrace farming and rainwater harvesting is well documented in Yemen and other arid regions (FAO, 2021a). These systems can be revived to mitigate water scarcity.
- **Invest in small-scale water desalination plants** along coastal areas where freshwater is scarce but solar energy is abundant (as piloted, for example, in Somalia and Djibouti) (IRENA, 2015). These plants could be powered by solar or wind energy to mitigate the country's energy shortages.
- **Promote community-driven water resource management** in partnership with NGOs that have a presence in remote areas.

These projects could involve local communities in monitoring water usage and maintaining reservoirs or aquifers.

4. Technical expertise, capacity development, and skills training on new practices

Delivering essential technical expertise is pivotal for enabling the adoption of new practices and strengthening climate resilience. This involves comprehensive training programmes designed to instil proficiency in innovative practices, including the adoption of climate-smart agricultural practices and efficient water management, as discussed above. The provision of knowledge and skills required for these evolving practices empowers local communities to navigate and adapt to the challenges posed by a changing climate. Engaging local communities in technical training, capacity development, and skills transfer ensures knowledge retention, long-term sustainability, and higher adoption rates of new practices like solar water pumping and climate-smart agriculture, reducing dependency on external aid (FAO, 2021b).

Cross-cutting policies

1. Education and awareness raising

Effective adaptation to climate change is heavily dependent on the accessibility of reliable information (Brookings Institution, 2022). Therefore, it is crucial to allocate resources towards expanding global awareness and investing in educational programmes to highlight the impacts of climate change. Equally important is encouraging community engagement in identifying solutions to climate risks. Greater awareness and education on climate change not only contribute towards enhanced risk management but also foster increased community resilience (Smith & Vivekananda, 2009). Strengthening public awareness can be achieved through open and transparent communication, public awareness campaigns, and tailored educational programmes.

The dissemination of climate knowledge must be approached with sensitivity to local contexts, ensuring that it is both trusted and easily understood (Smith & Vivekananda, 2009). This is particularly important in marginalised communities within FCS, where there may be lower levels of trust within local communities. Additionally, enhancing the climate knowledge base will also require encouraging knowledge exchange and transfer between think tanks and universities.

A more community-driven approach to education on climate adaptation could ensure better uptake of climate resilience practices:

- **Climate education programs should be tailored to local needs** and delivered through community radio, mobile platforms, and local mosques or tribal assemblies. These platforms could deliver targeted messages on water conservation, crop diversification, and early warning systems for natural disasters.
- **Encourage local schools to integrate climate change into their curricula** to foster long-term awareness. This can be supported by NGOs working in Yemen's education sector.

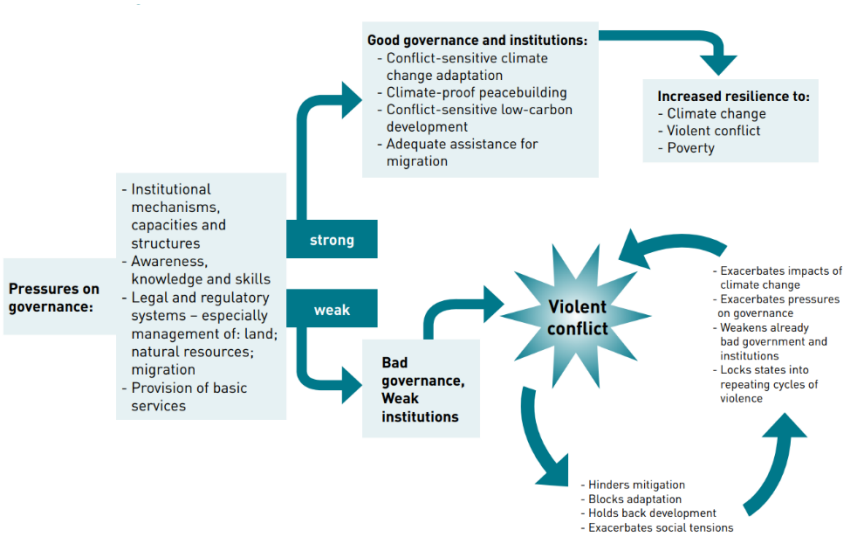
2. Strengthening governance and institutional structures

Strengthening governance and institutional structures is paramount to addressing the complex interplay between climate-induced tensions and conflict (Brookings Institution, 2022). FCS are typically characterised by weak institutions, rampant corruption, and limited rule of law. These factors collectively hinder the ability of states to effectively handle conflict, manage resources, and implement climate adaptation measures. Thus, strengthened governance and institutional capacity are critical in mitigating climate-induced conflict risks and displacement, as is illustrated in Figure 4 below (Adger et al., 2014). Institutional restructuring is equally important in addressing climate-induced challenges. This involves incorporating conflict sensitivity in policies to effectively build resilience in fragile states and exploring innovative institutional approaches that align with climate challenges, ensuring a more robust and adaptive response in fragile states (Smith & Vivekananda, 2009).

Given Yemen's governance challenges, building resilient institutions requires focusing on localised governance models:

- **Support the development of local governance structures** in relatively stable regions, focusing on rebuilding trust between the population and local authorities. These structures can manage local resources, implement climate adaptation projects, and facilitate public service delivery in the absence of centralised authority.
- **Enable local authorities to formulate and implement local economic development plans** focusing primarily on climate adaptation projects.
- **Leverage tribal governance and traditional dispute resolution systems** to manage local conflicts and resource-sharing agreements. Research on governance in fragile states (for example, Afghanistan, Somalia) suggests that tribal leaders and traditional governance systems can play a pivotal role in managing local resources and resolving disputes, especially when formal institutions are weak (Menkhaus, 2007).

FIGURE 4: Impact of governance and institutions on conflict and climate resilience



Note: Adapted from Smith and Vivekananda (2009).

3. International cooperation

International collaboration and support through the provision of external financing, technical assistance, and capacity development are pivotal for FCS to respond to climate challenges. The role of donor communities is particularly important in providing the funds and financing mechanisms needed to support adaptation measures. Key players active in this space include the *Global Environment Facility, Green Climate Fund, Arab Fund for Economic and Social Development (AFESD), OPEC Fund for International Development (OFID)* and multilateral development banks including the World Bank and Islamic Development Bank (WMO, 2020).

A significant challenge remains the lack of coordination, focus, and targeting among these diverse institutions (Brookings Institution, 2022). To address this, there is a need for these institutions to adopt a more streamlined approach, emphasising deliberate and targeted interventions. Coordinating these efforts with greater intentionality is essential for ensuring the efficient and impactful use of resources in addressing climate-related issues faced in FCS (Brookings Institution, 2022).

International efforts to support Yemen need to be better coordinated and tailored to Yemen's specific needs:

- **Establish a multi-donor trust fund** for climate resilience in Yemen, which pools resources from major donors like the World Bank, UNDP, and bilateral donors. Multi-donor trust funds have been successful in channelling international aid to fragile states, ensuring better coordination and monitoring. Examples include funds managed by the UN for Afghanistan and Haiti (Scanteam, World Bank, 2010). This fund

could focus on financing climate adaptation projects, especially in agriculture, water management, fisheries, and housing protection.

- **Encourage regional cooperation** by involving neighbouring countries in shared resource management, especially around water sources. Transboundary water resources, such as the Wadi Hadramawt Aquifer, Wadi Mawr, and Wadi Harad (all shared with Saudi Arabia), are often made subject to unsustainable extraction, occasionally resulting in disputes over water rights and upstream-downstream allocations. Initiatives like shared water agreements between Yemen and Saudi Arabia or Oman could promote stability and reduce resource-driven conflicts.

Conclusion

In conclusion, a holistic policy approach that addresses both immediate climate shocks and long-term resilience is critical to helping Yemen escape its climate-fragility trap. Given the country's protracted conflict, institutional fragmentation, and economic collapse, such an approach must combine urgent recovery measures with sustained efforts to strengthen governance, build institutional capacity, and invest strategically in climate-vulnerable sectors like agriculture, water, and infrastructure. For these efforts to succeed, international collaboration will be essential – not only in providing financial and technical support, but in ensuring that interventions are conflict-sensitive, locally grounded, and tailored to Yemen's complex and rapidly evolving context.

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