

The crisis within the crisis: Addressing spiralling climate and environmental risks in Taizz and Hadhramaut governorates

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Acronyms

ACLED	Armed Conflict Location & Event Data Project
AFFY	Affordability of Food and Finance programme
BCRVGRUAY	Building Climate Resilience for Vulnerable Groups of Urban and Rural Areas of Yemen
CCDR	Country Climate and Development Report
DAC	Development Assistance Committee (under OECD)
ECTP	Emergency Cash Transfer Programme
EIA	Environmental impact assessment
ERRY III	Supporting Resilient Livelihoods, Food Security and Climate Adaptation in Yemen
ESPECRP	Emergency Social Protection Enhancement and COVID-19 Response Programme (World Bank)
FCDO	Foreign & Commonwealth Development Office
FSSN	Food Security Safety Net programme
FSSRP	Food Security Response and Resilience Project
GCF	Global Climate Facility
GED	Georeferenced event dataset
IDP	Internally displaced person
IPC	Integrated Food Security Phase Classification – a multi-stakeholder initiative that classifies food insecurity
IPCC	Intergovernmental Panel on Climate Change
IRG	Internationally recognised government
ISF	Integrated Security Fund
LWSC	Local Water and Sanitation Corporation
MoAIF	Ministry of Agriculture, Industry and Fisheries
MoWE	Ministry of Water and Environment
MDTF	Multi Donor Trust Fund (World Bank)
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
OECD	Organisation for Economic Co-operation and Development
NSAG	Non-state armed group
OSESGY	Office of the Special Envoy of the Secretary-General for Yemen

PHENOMENAL	Pioneering a Holistic approach to Energy and Nature-based Options in MENA [Middle East and North Africa]
PMT	Proxy means testing
RAF	Resource allocation framework
SFD	Social Fund for Development (Yemeni government)
SIA	Social impact assessment
Sphere	A global network of humanitarian aid organisations that sets standards for humanitarian assistance
STAAR	Social Protection Technical Assistance, Advice, and Resources programme (FCDO programme)
STC	Southern Transitional Council
TAFFY	Technical Assistance Fund for Yemen
TAG	UN Special Envoy to Yemen
UNICEF	United Nations Children's Fund
YSF	Yemen Support Fund



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Introduction

This report responds to a request by the Climate, Environment and Nature (CLEAN) Helpdesk to support the UK government's Yemen Office Network (YON). The brief set out in the terms of reference is to:

- *'develop a robust evidence base of climate-related hazards that have the potential to exacerbate conflict and security risks*
 - *for areas under the control of the internationally recognised government of Yemen (IRG)*
 - *in order to shape stabilisation, peacebuilding, and security-related interventions to address emerging challenges.'*

The last point includes the planned creation of a new mechanism under the Integrated Security Fund to provide 'technical support to partners working at the intersection of climate change, conflict, and security'.

A key contextual fact is that there have been several assessments in recent years of the interactions between conflict risks, climate and environmental degradation in Yemen, which we draw from in this document. The report has accordingly been developed, in consultation with the YON, with three distinctive orientations:

- i. review present-day environmental stresses, explaining their central role in the humanitarian crisis and the conflict economy, with climate as one change driver amongst others;
- ii. position these drivers with respect to grievance narratives and the political economy of the conflict in two specific governorates (Taizz and Hadhramaut); and
- iii. identify how these dynamics affect the UK's high-level objectives in Yemen, and where and how the UK government can alter its approach for greater impact.

With these orientations in mind, the report is structured as follows:

Section 2 presents a conceptual framework discussing the causes and extent of environmental risks in Yemen, and the ways in which these interact with structural drivers of conflict. It goes on to outline the supporting empirical and analytic methodologies used in this paper.

Section 3 summarises relevant data and trends for Taizz and Hadhramaut governorates. The first sub-section discusses conflict and political dynamics, while the second unpacks four core environmental risks: (i) the overextraction of groundwater, (ii) the maladaptation of the agri-food sector, (iii) the degradation of water and soil resources; and (iv) the failure to mitigate extreme weather risks.

Section 4 discusses the two-way interactions between environmental and conflict risks. It is organised around three conflict pathways, namely (i) the entrenchment of the conflict economy; (ii) the securitisation of natural resource governance; and (iii) the declining legitimacy of the internationally recognised government (IRG). It goes on to discuss the significance of these environment–conflict pathways within the big picture of humanitarian, economic and security crisis.

Section 5 reviews how and where the three conflict pathways are addressed within existing climate and environmental programming in Yemen. It summarises findings regarding under-addressed dimensions and blind spots, and points out potential lessons for the engagement of UK international climate finance (ICF).

Section 6 brings together key takeaways and provides considerations for future UK Government engagement in Yemen. These considerations focus on how environment–conflict risks can be mainstreamed across different areas of the portfolio and, where appropriate, addressed through targeted initiatives.



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Approach and conceptual framework

2.1 Orientation

In recent years there have been multiple assessments of the interactions between the ongoing conflict in Yemen and environmental degradation (Mundy, 2018; al-Mowafak, 2021; Mohammed, 2023; Abo-Thrais et al., 2025). These have included several assessments of the ways in which climate change and environmental stresses intensify conflict risks (Huntjens et al., 2014; Lackner, 2021; Koefoed et al., 2023; Barry et al., 2024; Sana'a Center, 2025). Several of these exercises have sought to gather representative perspectives across different regions of the country through the use of surveys and key informant sampling (UNDP/FAO, 2023; Garcia et al., 2024). There have also been several studies examining the perspectives and circumstances of women and girls (DCAF, 2022; Chehab, Bayoumi and al-Dabal, 2023; Peace Track Initiative, 2024).

Against this background, the current study adds value by focusing on the implications of these relationships for HMG's high-level objectives, programmes and other lines of effort. The report aims to identify directly actionable findings. Three overall orientations shape the report:

a. Identify drivers of environmental change in relation to their expected impact

We have deliberately avoided climate change as the starting point of our analysis. The reason for this is the urgency of today's ecological pressures in Yemen and the fact that they are anything but new. Yemen has at various points been referred to as the largest humanitarian crisis in the world (e.g., Coppi, 2018; Oxfam, 2025). Water and food security, in particular, are well beyond crisis point as measured by any relevant normative standard. Recent estimates show that 17 million households are below the Sphere emergency threshold of 15 litres of water per day; that 50% of the population is in IPC Phase 3 ('crisis') or higher; and that the country accounts for 35% of all cholera cases globally. While climate change is contributing to these impacts, it is not the only driver of change, nor the most important (see UNDP, 2024b on land degradation; World Bank, 2023b on the water sector). As one interviewee in Yemen's Environment Protection Authority said, 'Society suffers from many environmental problems such as pollution, depletion, and solid waste – and society may be the cause of it. All of this has worsened due to the lack of awareness, authority, and enforcement.'

This is also one of the core IPCC findings on how to assess climate risks. The IPCC found that (i) near-term vulnerability depends more strongly on differences in vulnerability caused by human and natural systems, than on differences in projected climate hazards; and (ii) this vulnerability is ‘strongly influenced by past, present, and future patterns of human development’, including the unsustainable use and management of land and water resources (IPCC, 2023: 98).

This is true of ecosystem services everywhere. The best available estimate is that globally climate change is responsible for 10–20% of degradation in ecosystem function to the present day (IPBES, 2019: 252). In Yemen, the other direct drivers of ecosystem decline include:

- structural changes in agricultural land use from the 1970s onwards;
- the unsustainable proliferation of deep wells over the same timeframe;
- the unmanaged disposal of solid and liquid waste;
- conflict-related damage and deterioration of infrastructure; and
- more recent, maladaptive transitions in the primary sector over the course of the current conflict.

Behind this sit a number of clear indirect drivers. These include:

- Yemen’s oil-driven development trajectory (post-independence);
- an accompanying policy mix that has cultivated an export-led primary sector;
- rapid demographic growth and urbanisation;
- the macro-economic and fiscal crisis that has accompanied the national conflict; and
- overall political fragmentation and state weakening.

Therefore, it is critical to assess the status of ecosystem services and how they are expected to change under the influence of climate change and the driving factors listed above.

The water sector illustrates why this clarity of attribution to specific drivers is important. It is generally accepted that Yemen is one of the most water-scarce contexts in the world. Some estimates show annual demand exceeding renewable yield by 25–30% and a risk of total groundwater depletion within a few decades (Lewis and Monem, 2018; World Bank, 2024a). The primary driver of this trend is groundwater extraction for agriculture. At the same time, climate modelling suggests that Yemen may see increased precipitation under many scenarios by the end of the century. Currently, less than 5% of rainfall is captured. If rainwater were correctly captured and retained, an increase in precipitation may mitigate, rather than exacerbate, future water scarcity. Both groundwater overextraction and the capacity to capture precipitation are shaped by human governance and policy decisions. Therefore, describing water stress as caused by climate hazards (e.g. drying trends) without understanding the underlying drivers of vulnerability and exposure is not helpful in scoping or designing interventions (see Barry et al., 2024: 3; Koefoed et al., 2023: 2).

b. Recognise the political economy of ecosystem services

Attribution matters because the drivers of environmental risk do not arise in a socio-political vacuum. In Yemen, the governance of social-environmental systems – above all land and water resources – has always been integral to national and local political settlements (International Crisis Group, 2011; Huntjens et al., 2014). The World Bank describes crises in the primary sector and import/export markets as ‘old problems in new forms’ (World Bank, 2023: 61). One of our interviewees working in the agriculture sector in Taizz echoed this, saying, ‘Everything mentioned was present at the beginning of the war.’

This interviewee's statement may be too categorical. One of our main findings is that there have been rapid and maladaptive changes in the primary sector over the past four years in response to the specific security and economic conditions created by the national conflict (see Section 3). Nevertheless, the continuities between conditions now and conditions before the war are important. The agriculture sector remains central to sustaining regional political factions and irregular forces, as it has been since political unification in 1990. Access to land and rural livelihoods continues to play a critical role in intra-communal power dynamics, particularly for women and Yemenis of African descent. Management of critical leverage points in Yemen's outward-facing economy – ports, borders and import/export chains – has become a strategic imperative and is considered the war's 'most important lever' (International Crisis Group, 2022). Previously, these were already the site of inter-elite competition and large-scale protest movements, notably in 1994, 2011 and 2014.

For these reasons, in the context of conflict analysis, referring over-broadly to 'climate and environment' risk can do significant harm. The trap to avoid here is over-emphasising the role of changing climate conditions in exacerbating environmental risks, i.e. focusing on exogenous factors outside Yemeni control. This can result in under-emphasising the social, economic, and political choices that have set the country on this trajectory. We refer to this as a 'trap' because it de-politicises causal drivers that are fundamentally political and/or interest-driven in nature. One of the main themes of this report is that such ambiguities can create blind spots regarding the stakeholder interests and perceptions that make adaptation succeed or fail. In some contexts, this lack of clarity will outweigh the benefits of climate adaptation as a mutually agreeable common ground or entry point.

c. Position environmental risks within mainstream conflict analysis

It is well known that the links between climate-related environmental change and violent conflict are neither linear nor direct (Mobjörk et al., 2016; Rüttinger et al., 2015). In this paper, we therefore focus on how environmental risks interact with known structural conflict drivers. This includes the entrenchment of the wartime political economy; the securitisation of resource governance; and grievance-based narratives that question the legitimacy of the central government.

These dynamics are occurring simultaneously at multiple levels:

At the *national level*, the governance of land and water resources intersects directly with core macro-political questions including (i) the 'southern question' and the (perceived) co-optation of central government institutions; (ii) tensions over decentralisation and/or a potential federal model; (iii) the perceived legitimacy of the internationally recognised government (IRG) versus that of regional political factions; (iv) the militarisation of water sources and the governance of ecosystem services that cut across jurisdictional boundaries (notably water basins); and (v) the conflict economy that sustains the present impasse. (For the purpose of this paper, we limit discussion of oil revenues and governance, as this area is already politically visible and much discussed.)

At the *regional/governorate level* there are a range of 'vertical' grievances concerning the (perceived) co-optation and poor delivery of central government institutions, and the uncontrolled and exclusionary exploitation of land and water resources. There is also

considerable inter-communal ('horizontal') conflict over natural resources, where recent survey evidence has ranked the perceived drivers of conflict as (i) access, control and capture; (ii) management practices; (iii) land use practices (Garcia et al., 2024: 32).

At the *intra-communal level*, these broader risks and trends are not experienced equally. Yemen's women are much less likely to have formal property or labour rights than men; are proportionately more engaged in the agricultural labour force; and are primarily responsible for water collection and consequently exposed to illicit water economies. Yemenis of African descent (*Muhamasheen*) are disproportionately sited on marginal urban land and experience greater difficulties in accessing already insecure water supply. We discuss these factors in Section 3.

2.2 Conceptual framework

Figure 1 shows the conceptual framework of the paper, formulated in light of the above factors. The analytic starting point is the four environmental risks at the centre of the crisis, namely:

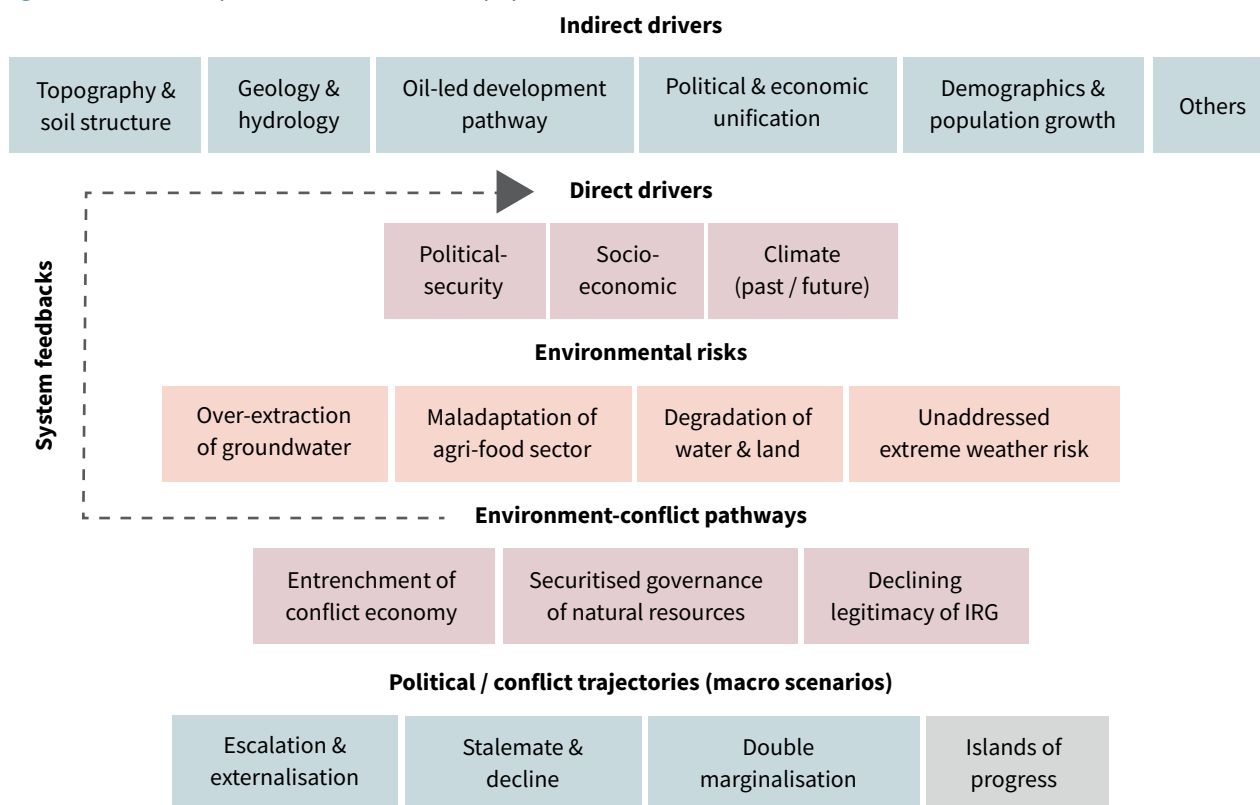
- the unsustainable extraction of groundwater;
- the maladaptation of the agri-food sector;
- the degradation of water, air, land and health; and
- unmitigated extreme weather risk.

These may be more accurately described as stress points in social-ecological systems, comprising both the ecosystem service itself and the private/public institutions that regulate its use and management. Throughout this document we refer to these central four issues.

Based on the framework shown in Figure 1:

- i. work "backwards" to map direct drivers of change including climate, along with indirect structural drivers (Section 3); and
- ii. we work 'forwards' to map potential conflict pathways and links into overall political-conflict scenarios for Yemen (Section 4).

Figure 1: The conceptual framework of this paper



Within this frame of reference, the focus is on Taizz and Hadhramaut governorates. The intention is to ground the analysis in the specific histories, stakeholder landscapes and lived experiences of these two governorates.

The macro-scenarios shown at the bottom of Figure 1 are defined in Table 1. These are adapted from published conflict and political economy analyses for Yemen as a whole (see, for example, Konrad Adenauer Stiftung, 2019; International Crisis Group, 2022; World Bank, 2023). They do not reflect the official position of the UK government. They are used to capture links with HMG objectives for engagement in Yemen; namely, advancing peace through support for the OSESGY-coordinated process; alleviating the humanitarian crisis; increasing economic stability; promoting security; and empowering women and girls. (OSESGY: Office of the Special Envoy of the Secretary-General for Yemen.)

For all scenarios, an important general attribute is the potential for self-reinforcing system feedbacks. This is because several of the most important direct drivers of environmental risks, shown near the top of Figure 1, are themselves exacerbated by ongoing conflict and political fragmentation. The most obvious example is the current food security crisis, which may be more accurately described as a food affordability crisis; the high cost of food is driven by currency depreciation and conflict-related interruptions of rural livelihoods and import/export markets.

The most immediate consequence of this feedback loop is that the status quo scenario shown in Table 1 is characterised by a stalemate in security terms but ongoing decline in environmental terms. Conversely the 'islands of progress' scenario is based on the interruption of this dynamic, whereby localised progress on critical environmental risks may contribute to a virtuous circle of partial economic normalisation and increased IRG legitimacy.

Table 1 outlines the characteristics of four possible scenarios for Yemen.

Table 1: Macro-scenarios and their characteristics

<p>Stalemate and decline (Continuation of status quo)</p>	<ul style="list-style-type: none"> • This scenario is characterised by continuity rather than change in the security landscape. Regional factions continue to have considerable autonomy. • De facto partition of territory continues; foreign actors provide support but rarely intervene directly. • Economic vulnerability to exogenous shocks; import and internal markets are regularly disrupted. • Environmental risks progressively intensify in the agri-food and water sectors, in some cases irreversibly. High vulnerability to natural hazards. • Humanitarian outcomes worsen where these are highly exposed to environmental risks (food security, access to water, water/vector-borne disease).
<p>Escalation and externalisation (Worst case)</p>	<ul style="list-style-type: none"> • Episodes of high-intensity/full-theatre conflict with significant impacts outside of Yemen (Red Sea, regional countries). • Major shifts in Houthi areas of control and NSAG areas of influence, with direct engagement in-theatre of foreign actors. (NSAG: non-state armed groups) • Severe constriction of import/export markets and collapse of some internal markets based on security conditions. • Fiscal and monetary crises worsen, with full withdrawal of line ministries from some areas. • Humanitarian outcomes deteriorate owing to lower access, increased costs, and growing environmental risks (especially food security, access to water, water/vector-borne disease).
<p>Islands of progress (Best reasonable case)</p>	<ul style="list-style-type: none"> • Optimistic scenario where IRG performs better (visibly) on critical environmental governance challenges in some localities. • Security and political fragmentation persist, subject to the OSESGY-coordinated Track 1 process. • Economic vulnerability to exogenous shocks persists; import and internal markets are normalised in some key areas. • Maladaptation of agri-food and water sectors is halted or reversed in targeted localities. There is progress on the mitigation of extreme weather risks. • Humanitarian outcomes remain at crisis levels but with increasing scope for a resilience and adaptation lens.
<p>Double marginalisation</p>	<ul style="list-style-type: none"> • Consistent with all other scenarios. • Women are highly exposed to violence and exploitation in illicit markets, owing to social roles and high reliance on agricultural livelihoods. • IRG has few options to support safety nets for vulnerable groups, with increased reliance on adverse coping strategies (especially food and water security). • Political and security fragmentation greatly reduces the effectiveness of normative/legal initiatives to protect the rights of vulnerable groups.

2.3 Methodology and data collection

Systematic literature review

In this study, the first step in developing the conceptual framework and supporting research tools was a review of both grey and academic literature. Because data at the governorate level is scarce and existing studies are limited (especially for Hadhramaut), we made a systematic effort to identify and analyse available resources, using them as a foundation for further investigation. To analyse security and socio-environmental issues in Hadhramaut and Taizz, we reviewed works published since 2010 that address the environment–climate–security nexus in at least one of the two governorates.

This process relied on a web-scraping approach combining keywords such as ‘Yemen’, ‘climate’, ‘conflict’ and ‘environment’ with references to Taizz or Hadhramaut. Additional thematic terms were ‘fishing and productivity’, ‘fishing and health’, ‘agricultural productivity’ and ‘land, agricultural productivity and water, crops and health’, and ‘infrastructure’.

From 287 references identified, 58 were retained based on the following criteria: accessibility; publication after 2010; relevance to the environment–climate–security nexus; explicit focus on at least one of the two governorates in the 21st century; and reliance on original qualitative or quantitative data collection. A detailed review of these works allowed us to further narrow the selection to 19 studies that provided in-depth analyses of Hadhramaut and/or Taizz. The final set of references included reports from transnational institutions such as the World Bank and broader United Nations systems; research institutions such as the Sana’a Centre; articles from peer-reviewed journals; and doctoral theses.

Semi-structured key informant interviews

Based on the information from these studies, we developed semi-structured questionnaires to test and triangulate the environmental risks and the associated environment–conflict pathways outlined in our conceptual framework. Several questionnaires were developed to target different local branches of national ministries, district authorities, civil society actors, climate and conflict specialists, water institutions, and the private sector. We interviewed about 20 key informants from the different stakeholder groups in each governorate for a total of 39 interviews (see Table 2).

Table 2: Organisations and key informants interviewed

Taizz	Hadhramaut
Agriculture Office	Al-Daidia Association
Agriculture Office in Al-Ma’afer Directorate	Al-Mukalla Directorate
Al-Shihab Tech for Solar Energy Systems	Al-Wusta University
Basmat Hayat Foundation	Beekeepers Association
Cairo Directorate	Blue Planet Center for Studies
Center for Strategic Studies for Women and Children Support	Former deputy minister

Taizz	Hadhramaut
Cleaning and Improvement Fund	Friends of the Environment Association
Environmental and Social Protection Consultant	General Authority for Environmental Protection Wadi Hadhramaut (Wadi Ghail Ba Wazir x2
Fishermen Association Al Makha directorate	General Authority for Environmental Protection, Al-Makla, Hadhramaut, Al-Dis
Food and Agriculture Organization (FAO)	General Authority for Rural Water Projects Mukalla, Al-Dis, Ghwayzi
Green Valley Association	General Authority for Water Resources
Insan Aid for Development	Local Authority
Joodn for Development and Peace	Local Authority in Barmim Directorate
Kayan for Peace and Development	Ministry of Agriculture and Irrigation
Ma'affer Directorate	Manager
Salsabil Water Purification Station	Office of Agriculture and Irrigation
Self-employed <i>qat</i> trader x 2	Peace and Justice Foundation
Social Fund for Development	Social Activist
Water Corporation	Studies Center
Yemeni Agricultural Institution	

Conflict-sensitivity analysis of existing climate and environmental programmes in Yemen

To assess how effectively the environmental risks and identified environment–conflict pathways are being addressed by interventions in Yemen, we conducted a conflict-sensitivity analysis of ongoing climate and environmental programmes (see Section 5). We compiled an initial inventory of active climate projects from the OECD DAC climate-related development finance database, websites of multilateral climate funds, and Yemeni government climate policy documents. We included the whole of Yemen since there was limited information on Taizz and Hadhramaut. This yielded 30 active projects approved between 2019 and 2025. For each project, we gathered key documents available online, including concept notes, full project proposals, proposal assessments, environmental and social action plans, and stakeholder consultation and inclusion plans, to run an *ex-ante* analysis of conflict sensitivity (i.e., based on design). Given the active status of projects, an *ex-post* analysis was not possible since no evaluations on achievements and lessons learned were available. Four projects had no publicly retrievable documentation, leaving 26 projects with a cumulative commitment of USD 650 million (see Annex 1).

As may be seen under ‘Conflict-sensitivity framework’ in Annex 1, projects are assessed according to four levels of increasing conflict sensitivity: ‘conflict-blind’, ‘conflict-aware’, ‘do no harm’, and ‘peacebuilding’. We used this framework to assess project documentation across

four dimensions: context analysis, design and activities, monitoring and reporting, and risk management. We then used the framework to train NotebookLM, a Google-powered large language model, and calibrated it based on five projects, assessing the level of conflict sensitivity of each and checking the results manually. However, to ensure an accurate analysis, we first assessed each project without using the trained AI model and compared these results to the Notebook LM results.

Despite the thoroughness of this analytical approach, we faced a key limitation in that we had to rely only on publicly available published information. We acknowledge that conflict analyses are political in nature and therefore can be highly sensitive. It is certainly possible that ongoing programmes have performed in-depth conflict analyses identifying wider linkages with regional and national dynamics that drive governorate to national conflict pathways. We have attempted to cover these linkages on the basis of the documents we had, acknowledging that organisations may have chosen not to release their findings as a means to do no harm.



Photo by Irwan zahuri

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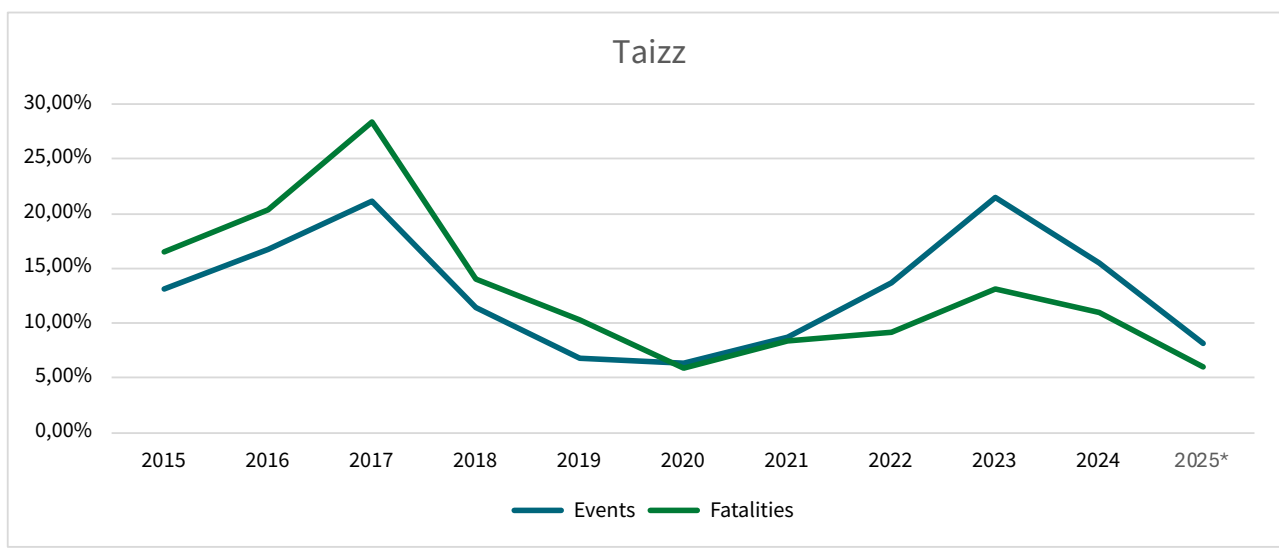
Context of Taizz and Hadhramaut

3.1 Conflict and political trends

a. Taizz

Taizz is Yemen’s most populous governorate, with 3.5 million inhabitants in 2023, situated in a territory of 12,605 km² (3% of Yemen’s territory). Taizz is currently divided between Houthi-controlled areas to the north and IRG-controlled areas in the south, with some areas in the east under the influence of the Southern Transitional Council (STC), a United Arab Emirates-backed ‘secessionist’ political organisation. In addition, local and tribal militias control certain crossing points (see Figure 3). Taizz is the site of the ‘longest-running battle ground in the Yemen war’ (Al-Deen, 2017). Between 2015 and 8 August 2025, 12.3% of all recorded political violence events in Yemen and 13.8% of their direct victims were in Taizz (see Figure 2 below).

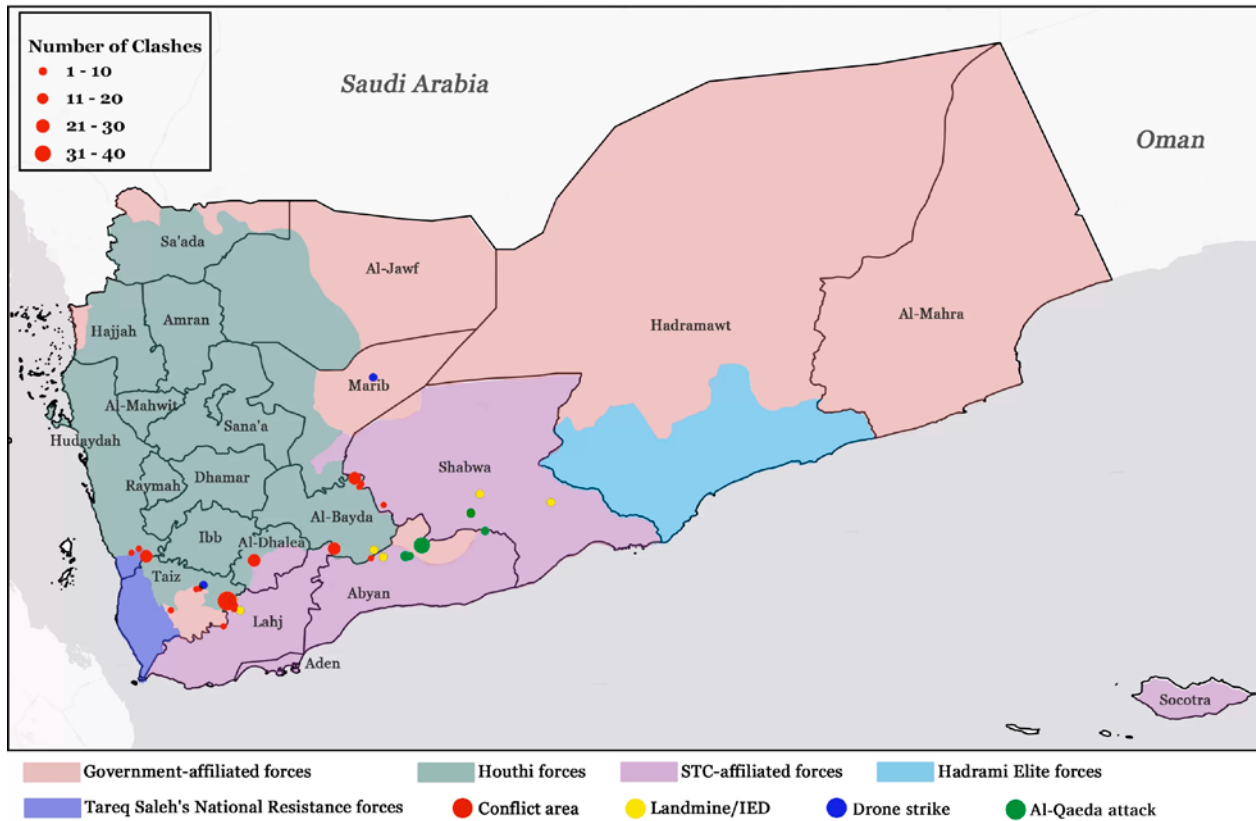
Figure 2: Share of Yemen’s political violence events and associated fatalities concentrated in Taizz governorate (2015–2025*)



* Data for 2025 stops at 8 August 2025.
Source: Authors, based on the Armed Conflict Location & Event Data Project (ACLED)

Taizz is a particularly strategic governorate for all warring parties, largely because of its location close to the Red Sea and the busy maritime corridor of Bab al-Mandab Strait, and the key role it played in Yemen's political history. Since 2015, its capital, Taizz city, has been under siege. The Houthi movement controls the industrial north of Taizz city, where they impose taxes on factory owners and the governorate's three main roads, where they set up blockades to prevent the movement of people and goods, including humanitarian aid (Alhaj, 2023; Saferworld, 2023).

Figure 3: Yemen zones of control (1 July–30 September 2025)



Source: Sana'a Center for Strategic Studies (2025).

Taizz's identity remains deeply fractured by layers of historical tension and marginalisation. Long before the 1990 unification, the governorate was part of North Yemen politically, yet its social and cultural formation was often more aligned with the south (Al-Deen, 2017; 2022). Taizz was a centre of administrative power, serving as capital during periods like the Rasulid Dynasty (1229–1454) and under Imam Ahmad's rule in the mid-20th century, while also maintaining significant ties with Aden through migration, commerce and education (Al-Deen, 2022).

In the 2010s, Taizz became a centre of opposition and rebellion against both the central government and the Houthis (Al-Deen, 2017). Taizz city was a key centre of protest during the 2011 Arab Spring, contributing to the fall of former President Ali Abdullah Saleh.¹ It became the locus of armed resistance against the Houthis at the onset of the 2014–2015 conflict, when it attracted diverse anti-Houthi fighters, including supporters of the Muslim Brotherhood-aligned

¹ See <https://www.nytimes.com/2011/02/26/world/middleeast/26yemen.html> and <https://english.alarabiya.net/views/news/middle-east/2015/09/24/Taiz-Yemen-s-forgotten-battlefront>

Islah Party, Salafists displaced from Sa'ada, and extremist factions linked to al-Qaeda and Islamic State. However, infighting among these groups, particularly between Islah and its rivals, has fractured the anti-Houthi coalition (Al-Awlaqi, al-Madhaji and Biswell, 2018; Farouq, 2021). Taizz has thus become emblematic of the broader fragmentation of forces opposing the Houthis.

This fractured history has made Taizz governorate a frontline of territorial contest, with its large population carrying much of the burden. Of Taizz governorate's five water basins, two are controlled by the Houthis, two lie in frontline conflict zones and are inaccessible, and one remains under government control (Human Rights Watch, 2023). Taizz city, the country's fourth-largest urban centre (CSO, 2025), has faced repeated shelling in urban areas and years of blockade; journeys that once took 15 minutes can now stretch to eight hours, cutting off markets, healthcare, and humanitarian access. The blockade has driven up costs, worsened food insecurity, and forced waves of displacement (Saferworld, 2023). The Houthis have weaponised² water by blocking flows from the basins they control to government-held Taizz city, restricting access to water trucks, denying humanitarian agencies entry, and reportedly laying landmines near water infrastructure, leaving residents heavily dependent on limited and disrupted water supplies (Human Rights Watch, 2023). Those who have fled the city have lost homes and livelihoods and are dependent on families and host communities elsewhere in the governorate, who are themselves struggling under the pressures of war. Reopening access to Taizz city is a recurring but unresolved issue in peace talks. Selective openings in Houthi- and STC-controlled areas reinforce perceptions of double standards,³ since agreements on IRG-held routes consistently fail.

In the IRG-controlled areas of Taizz, local councils, local leaders and civil society are struggling to maintain peace by mediating disputes between factions. Local councils work closely with tribal authorities to understand local dynamics and prevent cycles of retaliation, through, for example, prisoner exchanges, but their capacity is constrained by high levels of need, limited resources, challenges to their credibility, weakened institutional cohesion, and eroded public trust (al-Awlaqi, al-Madhaji and Biswell, 2018). Given the weakness of local councils, civil society organisations (CSOs) in Taizz have taken on a central role in dispute resolution through dialogue and local mediation, despite their lack of funding and the security risks they face (Alhaj, 2022). Numerous peace initiatives are emerging in this governorate, including by local reconciliation committees supported by Yemeni and international institutions, which have facilitated ad hoc agreements to reopen certain roads.⁴ However, talks have failed on the issue of security control at crossing points. Finally, discussions between the various forces in Taizz, notably the IRG and the Houthis, mediated by Oman and Saudi Arabia (itself a participant in the conflict) are continuing informally. There have been some prisoner releases and the reopening of strategic roads, but the results remain largely intangible.⁵

In Taizz city, women, youth (about 60% of the population) and IDPs are especially affected by the lack of economic opportunities. Conservative gender norms intersect with economic collapse and insecurity to limit women's access to livelihoods, decision-making, and economic opportunities, leaving many jobless and vulnerable (UN-Habitat, 2020). Nonetheless, these same conditions

2 In this report, the weaponisation of water describes how water can become entangled in conflict, not only as a direct tool of control or deprivation, but also indirectly, in the information sphere of warfare, where narratives around water access are used to shape public opinion or political legitimacy. Both forms make water central to the conduct of war, even when the true intentions behind such actions, as in the obstruction of water transport to Taizz, remain uncertain.

3 See, <https://amwaj.media/en/article/in-taiz-siege-yemenis-see-houthi-double-standards>

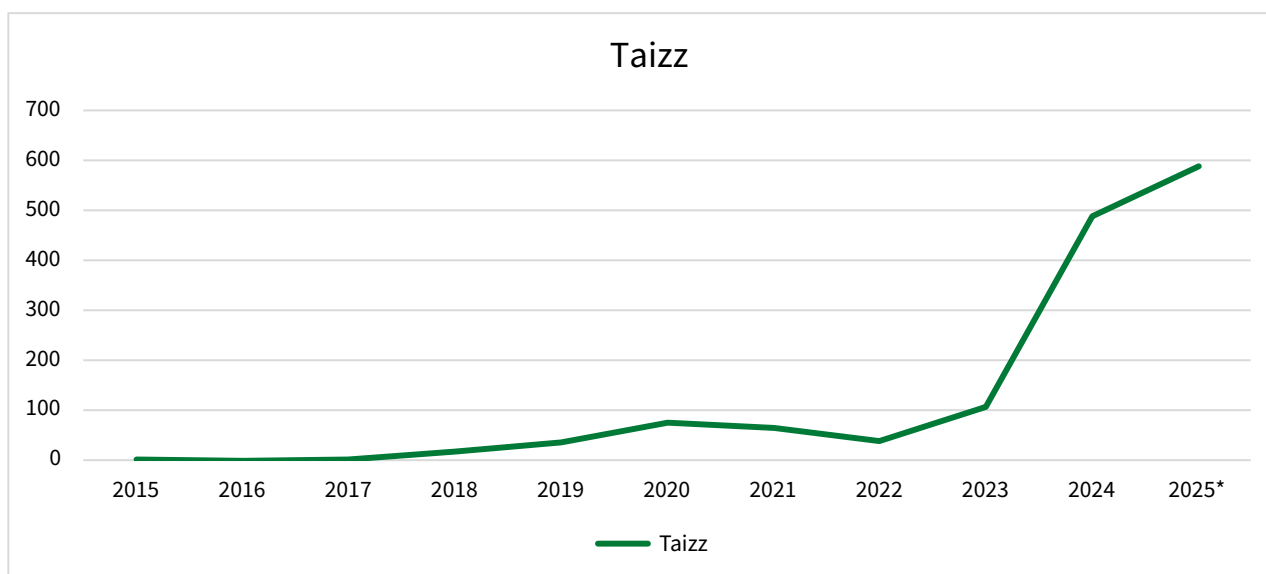
4 See, <https://sanaacenter.org/the-yemen-review/july-sept-2024/23529>

5 See, <https://south24.net/news/newse.php?nid=4049>

have driven shifts in gender roles; women have emerged as protest leaders, negotiators with armed groups, organisers of relief, and informal health providers, roles that expand their influence yet often increase exposure to retaliation and economic exploitation (ibid).

Demonstrations have also become a vital means for the population to voice demands for peace, essential services, and accountability from local authorities. These protests are mainly gatherings demanding greater access to water, electricity, and food, as well as local security.⁶ Some are also against the partial siege that has been imposed by the Houthis since 2015, calling for the reopening of roads and economic recovery. These calls have been moderately successful. The sharp increase in the number of popular protests in Taizz since 2022 (see Figure 4 below) is a key concern. These are strong contra-indications for the legitimacy and capacity of the IRG relative to regional political factions, and of public dissatisfaction with the stalemate in the national ‘Track 1’ process. It is also likely that the protests will be instrumentalised specifically by local political/security actors, if they have not already been. By 8 August 2025, the number of demonstrations in Taizz in 2025 (588 events) had already surpassed the total recorded in 2024 (488 events).

Figure 4: Number of demonstrations in Taizz (2015–2025*)



* Data for 2025 stops at 8 August 2025.

Source: Authors, based on the Armed Conflict Location & Event Data Project (ACLED)

In short, Taizz’s strategic location, entrenched frontlines, and fragmented anti-Houthi forces make it unlikely that the security situation will stabilise in the near term. The prolonged siege and politicisation of road access ensure that humanitarian needs will remain acute, while economic collapse and targeted access restrictions deepen the suffering of civilians, especially women, displaced people, and other marginalised groups. The growing number of protests since 2022 reflects both the worsening needs of the population and the increasing risk that their grievances will be exploited by the parties involved in the conflict.

⁶ See, <https://www.yemenmonitor.com/en/Details/ArtMID/908/ArticleID/145522>

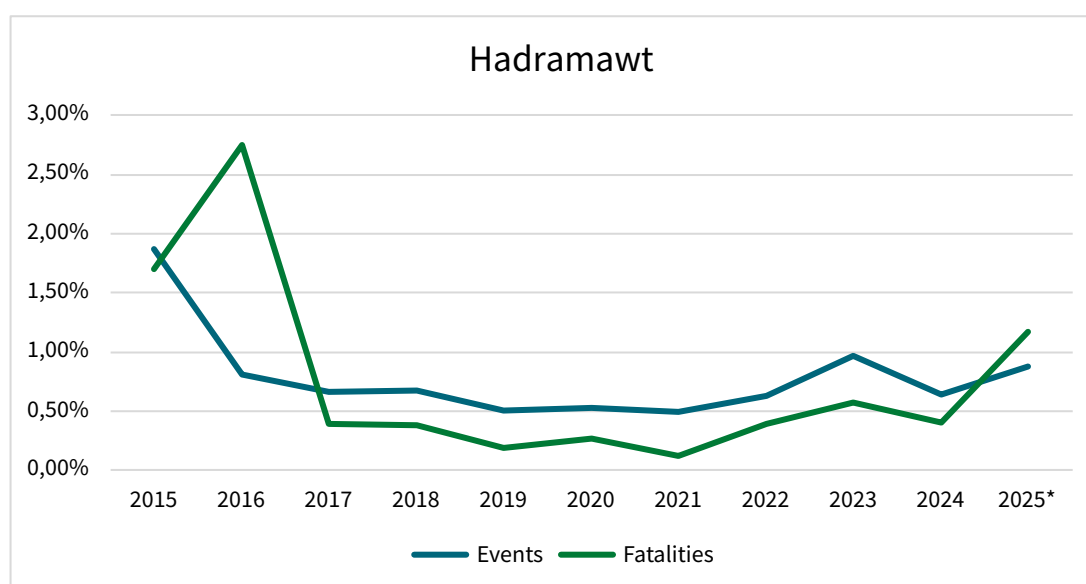
b. Hadhramaut

At approximately 191,737 square kilometres, the governorate of Hadhramaut in the east is the largest and one of the most resource-rich governorates in Yemen. It is rich in oil⁷ and gas reserves and has critical infrastructures such as the port of al-Mukalla and al-Shihr oil terminal on the south coast, the land port of al-Wadia in the northwest – the only crossing leading into Saudi Arabia – and various private- and public-run power plants in Wadi Hadhramaut and Coastal Hadhramaut.

Hadhramaut is divided into two zones of control. Coastal Hadhramaut (or Hadhramaut al-Sahil) in the south is controlled by the Emirati-backed Hadhrami Elite Forces that fall under the operational command of the STC (United Nations Panel of Experts for Yemen, 2018). Wadi Hadhramaut (Hadhramaut al-Wadi and al-Sahr), composed of valleys and deserts in the centre and north, falls under the First Military Region, the Sayun city-based commanding military division led by officers with long-standing ties to the Islamist Islah party and loyal to the IRG (ACLEDD, 2024).

These political divides, rooted in historical ‘vertical’ grievances between the national government and regional factions, have generated recurring tensions between competing political groups. Although this governorate experiences fewer Houthi incursions than the others, the political divisions have been the bread and butter of Al-Qa’ida⁸ who took over the governorate capital of al-Mukalla in April 2015 for a year (ACLEDD, 2024).

Figure 5: Share of Yemen’s political violence events and associated fatalities in Hadhramaut governorate (2015–2025*)



* Data for 2025 stops at 8 August 2025.

Note: Political violence events include battles, violence against civilians, explosions/remote violence and mob violence.
Source: Authors, based on the Armed Conflict Location & Event Data Project (ACLEDD)

7 The Masila basin (25,000 square kilometres), one of Yemen’s two main petroleum-bearing regions, contains about 80% of Yemen’s known oil reserves (al-Eryani, 2020).

8 Authors’ analysis of Uppsala Conflict Data Program (UCDP) Georeferenced Event Dataset (GED) Global version 25.1.

ACLED data indicates that while Hadhramaut remains a relatively minor arena of political violence at the national scale, this form of insecurity is on the rise with significant and lasting implications for the population, local stability, and the IRG government finances. The violence includes repeated Houthi attacks on strategic oil ports⁹. In 2024, 241 violent events (political and other types, such as violence during demonstrations) were recorded in the governorate. These constituted just 1.7% of Yemen's total number of incidents, but because the incidents and the population are highly concentrated, an estimated 382,648 people were directly exposed, making Hadhramaut the 7th most affected governorate out of 22.

Recurring demonstrations and riots in Hadhramaut have become a major security concern, amplified by political competition and the dormant and fragmented presence of AQAP-related actors (Kendall, 2021).¹⁰ Corruption and the collapse of basic services, especially electricity, with chronic outages, have fuelled protests among urban youth, workers, and marginalised groups. The protests are frequent in the urban centres of Hadhramaut, particularly in Mukalla (the coastal capital) and Seyun (the administrative capital of Wadi Hadhramaut), but also in inland towns such as Tarim. There is a difference between the types of protests that erupt in rural and urban areas: Urban areas experience more roadblocks, tyre fires, occupations of administrative buildings and coordinated shop closures, while protests in the interior of the governorate, such as in Tarim (which remains an urban area), or in smaller, more inland localities, are more peaceful and mild, taking the form of strikes and marches accompanied by demands. The population generally protests against the deterioration of public services (including water shortages and power cuts of more than 20 hours a day), the depreciation of the local currency, and rising fuel prices. The recent surge in riots (five events during the week of 2 August 2025), unique to Hadhramaut compared to other governorates, signals a dangerous turning point toward prolonged social unrest (see SARI Global, 2025).

In terms of the political situation, Hadhramaut is the centre of tensions between the IRG, the Hadhrami Tribal Alliance and the STC. Negotiations have already taken place as part of a dialogue organised by actors such as the UN (Amman, October–December, 2024, Aden, 2025),¹¹ but no profound changes have been implemented and the Tribal Alliance continues to demand self-governance.¹² Nevertheless, these negotiations are currently allowing a channel of communication to be maintained between rivals, helping to ameliorate direct confrontations, although these have not disappeared.

In short, Hadhramaut is central to Yemen's energy production and thus to state finances. However, widespread frustration over resource management and failing service delivery has fuelled unrest. These grievances, when combined with entrenched political divides and the dormant presence of Al-Qaeda in the Arabian Peninsular (AQAP), place the governorate at a dangerous turning point toward civic instability, with the potential to become a major hub of political violence in Yemen.

⁹ See <https://sanaacenter.org/the-yemen-review/october-2022/19013>

¹⁰ See also the 36th report of the Analytical Support and Sanctions Monitoring Team submitted pursuant to resolution 2734 (2024) concerning ISIL (Da'esh), Al-Qaida and associated individuals and entities. <https://docs.un.org/en/S/2025/482>.

¹¹ See <https://osesgy.unmissions.org/third-public-report-political-dialogue-series-held-aden-january-14-22-2025-advance-yemen%E2%80%99s-peace-0>

¹² See <https://sanaacenter.org/the-yemen-review/april-june-2025/25083>

3.2 Resource governances

Historically, tribal societies in Yemen have played a central role in managing access to natural resources including water and land. Tribal structures have often filled the deficiencies of weak or absent state authority, blending customary law, mediating processes, and social stratification to monitor resource governance and ensure communal harmony. Tribal authority functioned as both a political and economic system, controlling access to resources through customary arrangements such as *urf* (customary law) imposed by sheikhs and councils (*majalis*), securing the sharing of resources, and resolving conflicts at the community level (Al-Dawsari, 2012). These customary laws differ from one area to another, depending on the source, the level of need, the method of use, and the mechanism agreed upon by local communities. These structures maintain social and environmental equilibrium, especially in semi-arid zones that depend on reciprocal water flows.

Although tribal law remains dominant in many areas for social and practical reasons, its influence has weakened over time. Notably, community-based systems that historically regulated water use and enforced customary law were weakened by the introduction of groundwater pumps in the 1970s and the discovery of oil. This has increased competition over modern boreholes and fuelled local disputes.

Since the establishment of the Republic of Yemen and especially after its unification in 1990, the state has been governed by formal legislative structures, including a constitution and civil and regulatory laws, through government institutions (Adra, 2006). Yet national-level governance frameworks to manage natural resources remain weak. Yemen's Water Law No. 33 (2002) was intended to promote sustainable and equitable water use, including through a licensing system for wells. Enforcement has been limited, and many wells remain unlicensed (Taher et al., 2010). Communities that have sought to block harmful or excessive well drilling by appealing to local councils, security forces, courts, or the National Water Resource Authority have mostly been unsuccessful (ibid).

In practice access to resources, under the circumstances of the national conflict, is often closer to anarchy. Rules and institutions exist, but they rarely operate as intended. Governance mechanisms, when they do exist, tend to be at the local level, and higher authorities are often unaware of or disconnected from them. The lack of preparedness, data collection, and coordination all stem from this complex and fragmented context. As a result, resource use is shaped more by local power dynamics and immediate survival needs than by national policies or sustainability goals.

Disruptions to public electricity supply in Hadhramaut and its complete shutdown in Taizz have pushed households and farmers towards independent energy sources, particularly for water pumping, making these practices even harder to regulate (Ersoy et al., 2022). Before the war, Yemen's electricity sector was already weak (Almohamadi, 2021); capacity was low, losses were high, and access was limited (40% nationally, 23% in rural areas). The war caused near-total collapse – 90% of the population now has no access to public electricity. Only a third of pre-war capacity remains, serving local needs only, with households accounting for around 73% of total electricity consumption (Almohamadi, 2021; Ersoy et al., 2022).

The overall picture is one in which multiple governance vacuums overlap. With institutions unable to enforce regulations or coordinate across sectors, natural resource management depends on local arrangements that vary widely from one area to another. This fragmented landscape leaves room for contestation and conflict, as access and control over key resources are negotiated, or fought over, without a functioning system to mediate competing claims.

a. Taizz

Water governance in Taizz is undermined by overlapping mandates and legal ambiguity that make regulatory enforcement almost impossible (Van Rijswick et al., 2014). The Taizz branch of the National Water Resources Authority (NWRA) operates on a minimal budget, around USD 10,000 per year, and lacks the capacity to monitor or control groundwater extraction (ibid). An unclear division of responsibilities between national and local authorities and protracted dispute resolution processes weaken traditional leadership and fuel public frustration with distant, centralised decision-making.

In this vacuum, access to water depends less on rules than on power and proximity. Many shallow communal wells have dried up as deep private wells multiply nearby, often drilled to irrigate crops of *qat*, a stimulant drug (Van Rijswick et al., 2014). The result is growing competition and resentment among users. Disputes over groundwater have become frequent, reflecting not only scarcity but also a collapse of confidence in formal regulation.

The problem goes beyond ‘lack of coordination’. It is about the absence of trust between communities, local authorities, and external actors. In Taizz, where power is fragmented and loyalties are local, attempts to manage water collectively often fail because no actor is perceived as neutral or legitimate. Recent externally funded well projects to alleviate the water needs of Taizz city, such as those in Al-Dhubab backed by the UAE through resistance forces led by Tariq Saleh, faced community resistance over fears that new deep wells would further deplete existing aquifers.¹³ These reactions reveal long-standing mistrust and the absence of transparent consultation or accountability.

In 2025, an online meeting convened by the Sana’a Centre¹⁴ discussed a new agreement between local authorities and the Houthis to pump water from Al-Hawban into the city in phases, and to allow the LWSC to access and repair infrastructure across frontlines. Despite these efforts, many doubt the project’s durability; residents worry that the Houthis could halt it at any time. As one participant put it, ‘The water sector has received substantial organisational support, yet people still do not have access to water.’ The issue is not a lack of initiatives, but the absence of credible institutions to sustain them.

Information gaps compound these problems. There is little documentation of previous projects or local initiatives, making it difficult to learn from experience or build on existing practices. Some examples of local regulation exist, such as in Almaafer and Qadas, where community authorities have restricted or prohibited new wells, and in the Al-Sinah cooperative established in the 1960s, but evidence of their current activity is limited (Taher et al., 2012).

These fragmented relations make it extremely difficult to plan. The same mistrust and institutional weakness that affect daily water management also undermine efforts to anticipate

¹³ See <https://almushahid.net/116869/refer>

¹⁴ See Sana’a Center webinar: ‘Water Crisis in Taiz: Challenges and Potential Solutions’, <https://www.youtube.com/watch?v=4jM8LTKypAk&t=12s>

and respond to longer-term risks. Climate funds and climate change projects including early warning systems rely on data, coordination, and timely information sharing, none of which can function where institutions do not communicate or are not trusted. Local authorities lack the means to collect climate data or prepare comprehensive plans. As a result, responses to droughts, floods, and changing rainfall patterns are reactive and uneven. The absence of credible coordination mechanisms turns every environmental shock into a governance test, deepening both vulnerability and mistrust.

b. Hadhramaut

Hadhramaut, the largest and one of the most resource-rich governorates, presents a critical paradox of significant natural wealth existing alongside severe governance failures. The governorate's substantial oil reserves, agricultural land, and water resources are managed by a complex interplay of local traditions, political fragmentation, and institutional weakness. This type of governance, exacerbated by the national conflict and climate change, turns resource management into a primary arena for political and local conflict (Sana'a Centre, 2025).¹⁵ Resource governance, particularly oil, is crippled by overlapping mandates and competing power centres. The Southern Transitional Council (STC), the Hadhramaut Tribal Alliance, and the central government vie for control (Al Jazeera, 2025). This political and military fragmentation deeply affects the governance of its natural resources, resulting in 'disjointed and inefficient climate responses' (Nasser, 2024).

Local government institutions (where they function) are hamstrung by a severe lack of capacity. Locals reported 'the absence of official institutions' and officials acknowledge 'insufficient financing, a lack of technical skills, and inadequate training',¹⁶ compounded by weak regulatory frameworks and inconsistent enforcement (Nasser, 2024). This institutional paralysis creates a gap, with access to resources determined not fully by law or equity, but by power and proximity. These factors are embedding resource wealth within a framework of political struggle rather than development (Sana'a Center, 2025). This is evident in tribal demands for autonomy and grievances that power centres are 'exploiting resources without providing services'.¹⁷ Here, there is no single actor who would be impartial or legitimate enough to rule over resources collectively, leading to reactive and often adversarial community responses.

The National Water Resources Authority (NWRA) and the Local Water and Sanitation Corporation (LWSC) in Hadhramaut operate with limited budgets and overlapping mandates. As in Taizz, the absence of clearly defined areas of responsibility for national and local authorities has hampered the implementation of groundwater regulations (Lackner, 2021). There has been a decline in the use of traditional techniques and an increase in the number of groundwater wells (built in many cases without a sufficient buffer zone of 100 metres) and solar-powered pumps, resulting in a significant new threat to groundwater resources. Local councils remain under-resourced, while inter-agency coordination is constrained by political interference and dependence on donor-driven projects. As a result, tribal groups have resisted the centralisation of water governance, demanding local control of aquifers (Sana'a Center, 2025).

¹⁵ See also Yemen Monitor (2025). Hadhramaut Governor's Decision to Change Al-Abr Management Sparks Conflict. Available at: <https://www.yemenmonitor.com/en/Details/ArtMID/908/ArticleID/148607>

¹⁶ Klls

¹⁷ See Najla Al-Ezi (2025). Hadhramaut Political Forces. Khulasat. <https://khulasat.org/ar/posts/Hadhramaut>

Political fragmentation not only undermines trust but also disrupts data collection and coordinated responses to droughts or floods. This disunity mirrors patterns documented elsewhere in Yemen, where overlapping jurisdictions create governance vacuums vulnerable to both environmental and conflict-related shocks (Nasser, 2024).

Despite these challenges, Hadhramaut's communities exhibit notable resilience in coping with climate/conflict variability. Local associations, irrigation cooperatives, and informal water committees have reactivated the traditional value of solidarity to manage water scarcity and restore small *qanats* or shared pumps.¹⁸ Furthermore, Hadhramaut has emerged as a pilot area for climate-related early warning systems (EWS) supported by international initiatives. Local meteorological units in Mukalla and Say'un have begun integrating satellite rainfall mapping with community reporting networks to forecast flash floods and drought episodes. These systems face operational obstacles: limited technical training, inconsistent data flows from remote districts, and inadequate communication between national authorities reduce the efficacy of early alerts (Aklan, 2023).¹⁹

3.3 Environmental risks

Yemen's population is living under acute environmental stress. The country's arid climate has long created structural constraints, but the combined impact of conflict, political fragmentation, economic crisis, and one of the world's fastest population growth rates (around 3% per year²⁰) is driving pressure on land, food, and water to breaking point.

Since the outbreak of the conflict in 2014–2015, real GDP has contracted by an estimated 54%, while public revenues have collapsed by more than two-thirds, largely as a result of Houthi blockades on oil exports (World Bank, 2024b). These severe fiscal pressures have placed agricultural livelihoods in a precarious position; investment in agriculture has dwindled, access to modern technology for smallholders has narrowed, and resource governance has further eroded (Muharram and Alsharjabi, 2019). Monetary constraints are severe, with the sharp depreciation of the Yemeni Rial (YER) placing additional pressure on the country's terms of trade. This is particularly significant, given that Yemen imports around 90% of its food and continues to face high fuel costs, a structural characteristic of the economy rather than solely a consequence of the current conflict. The fishing and agricultural sectors are struggling to meet local demand, and increasingly inclined to switch to competitive products and/or external markets, or to quit their activity.

Households are the first to feel the impact, as staple food prices have surged (by 25–70% for wheat, millet, and sorghum). The cost of the minimum food basket rose by 34% in Taizz and 25–29% in Hadhramaut between 2024 and 2025 (Muharram and Alsharjabi, 2019; WFP, 2025). Taizz produces 42% of Yemen's grain and 45% of its vegetables, and Hadhramaut is a key supplier of dates, vegetables, and fodder (CSO, 2025), yet half the population faces acute food insecurity. In total, 58% of households in Taizz and 41% in Hadhramaut are unable to meet minimum food needs (IPC, May–Aug 2025).

¹⁸ Klls

¹⁹ See also <https://south24.net/news/news.php?nid=4888>

²⁰ Yemen has one of the world's highest fertility rates, with 4.6 children per woman in 2023 (CSO, 2025).

Over 13.6 million people lack an improved water source, and 17 million fall below the Sphere minimum of 15 litres per person per day (OCHA, 2025). Sanitation infrastructure is severely deficient; only 0.8% of the population is connected to sewerage systems and only 5% benefit from a formal sanitation service (CSO, 2025). Yemen alone accounts for 35% of global cholera cases and 18% of global mortality, with outbreaks concentrated in densely populated, conflict-affected areas where water systems have been damaged (WHO, 2024; Tarnas et al., 2023). Other diseases, including dengue fever, cutaneous leishmaniasis, and toxoplasmosis, exploit gaps in infrastructure, housing, and degraded environments (Alyousefi et al., 2016; Asmaa et al., 2017; Mahdy et al., 2017; Tarnas et al., 2023).

3.3.1 Overreliance and overexploitation of groundwater

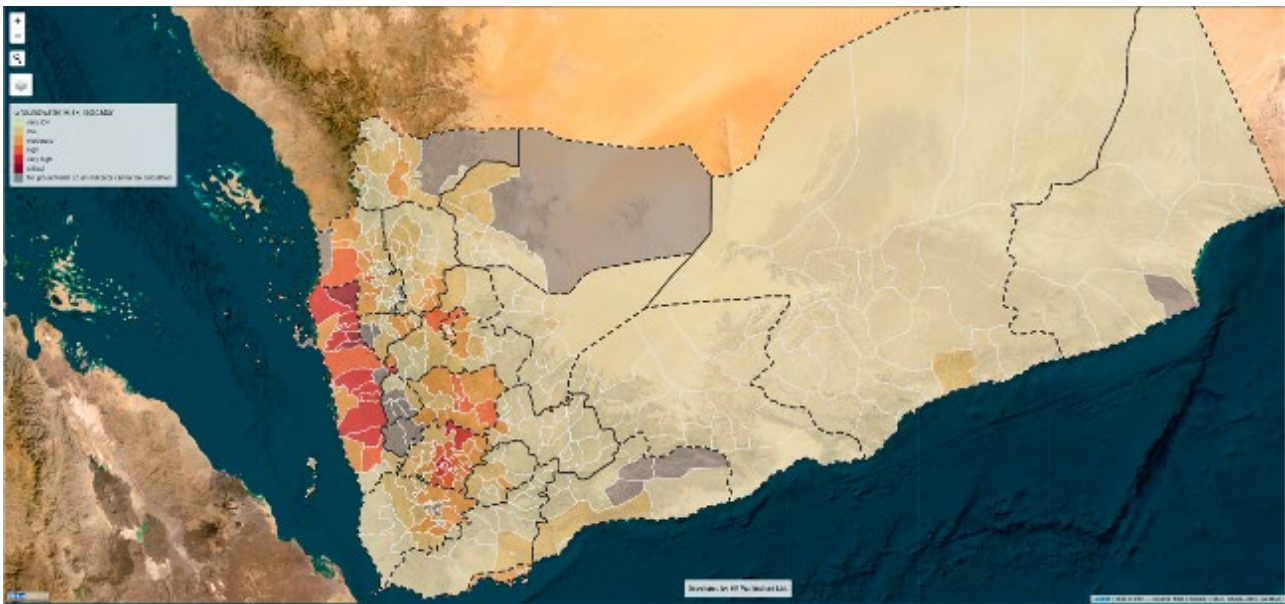
Yemen's arid and semi-arid environment, shaped by complex topography, is characterised by high temperatures and limited rainfall, with mean annual temperatures rising by 0.42°C per decade between 1971 and 2020 (World Bank, 2024a). Weak precipitation, decreasing by -6.25 mm per decade over the same period (World Bank, 2024a), and increasing heat exacerbate hydrological stress by reducing surface water availability and accelerating evaporation (Al-Mahfadi, 2020). With less than 5% of rainfall retained, surface and groundwater resources are being exploited far beyond their natural recharge rates (World Bank, 2024a; Almas and Scholz, 2006). As a result, average annual per-capita water availability has plummeted to just 65 m³ – one-eighth of the global threshold for absolute scarcity (500 m³). This represents a 60% decline in water availability since 1990. Per-capita water availability is projected to fall further to only 54 m³ per person by 2050 (World Bank, 2024a).

Traditional systems of groundwater management such as *qanats* and communal dykes have declined (Baquhaizel, Saeed, and Bin Ghouth, 2011). Since the 1970s, they have been replaced by tube wells and motorised pumps that initially expanded irrigation but entrenched unsustainable extraction (Taher et al., 2012). What was once managed collectively has become, in the words of many respondents, 'random' and 'chaotic'. Unregulated drilling, rapid depletion, and unequal access deepen structural vulnerabilities. Wealthier farmers can afford to dig deeper, while smallholders lose access and are forced into precarious labour in agriculture or urban centres (Lackner, 2020; 2021).

a. Taizz

Taizz received an average of 299.77 mm of precipitation per year between 1991 and 2020, higher than the national mean of 189.91 mm, supporting the primary agricultural producing areas (World Bank, 2024a). Higher evapotranspiration rates and over-abstraction, however, have led the Tawilah Sandstone aquifer to recharge slowly. Expanded damming and the widespread diversion of rivers and springs for irrigated agriculture drawing seasonal surface water from Wadi Rasian, Wadi al-Dhabab, and Wadi Warzan have also dried many watercourses (Al-Mahfadi, 2020). In addition, the war and Houthis' control over some water basins have restricted the capacity of public water supplies (Human Rights Watch, 2023). As a result, satellite analysis shows much higher groundwater depletion risks for Taizz than for Hadhramaut (HR Wallingford, 2025) (Figure 6).

Figure 6: Yemen groundwater risk assessment based on satellite data analysis



Note: This image was generated by the groundwater risk index developed by HR Wallingford using satellite information. The study has not been validated by on-the-ground data owing to limited access caused by the conflict. Darker red areas indicate areas with higher groundwater depletion risk.
Source: HR Wallingford, 2025.

Population growth and migration from villages to the city increase pressure on water resources and contribute to their depletion (Naser et al., 2018). In densely populated areas such as Taizz city, groundwater levels are falling by 6–8 metres per year, forcing reliance on non-renewable fossil aquifers that are also nearing exhaustion (Al-Mahfadi, 2020). Rural–urban water transfers are an historically important political issue in Taizz, causing civil unrests in the 90s and armed resistance against water transfer projects that would have deprived populations of water for agriculture (Lackner, 2020).

Women have greater responsibilities for water but lack specific rights over its access or management. They face higher burdens and security risks by having to fetch water and manage household needs amid scarcity (Van Rijswick et al., 2014).

b. Hadhramaut

Hadhramaut, situated in the coastal and sparsely populated desert area in the east, experiences extreme heat and aridity, receiving annual mean precipitation of only 122.17 mm compared to the national mean of 189.91 mm between 1991 and 2000. Rainfall variability is high, with the driest months of June and December receiving mean precipitations of 10.37 mm and 2.49 mm respectively, leading to arid conditions with scarce vegetation (World Bank, 2024a). Seasonal surface water is drawn from Wadi Hadhramaut which drains the inland plateau during rainy seasons. There is no perennial water supply in most areas during the dry season.

Groundwater from Mukalla Sandstone aquifer (the largest freshwater aquifer in Yemen, extending into Saudi Arabia and Oman) is the main source of water for the growing population. This aquifer is now being abstracted about ten times faster than it recharges. Levels have declined by about 0.6 m per year or more since 2015 as reduced rainfall coincides with rising agricultural demand (Guppy and Alnabhani, 2022).

The main wadi bed in the valley carries water only during heavy rains, producing flash floods that leave little time for infiltration or recharge of shallow groundwater (Van den Berg et al., 2021). Major flash floods in 2008 damaged water infrastructure, causing loss to the value of USD 1.64 billion. Since then communities in the valleys have become highly dependent on fossil aquifers (ibid).

Box 1: Groundwater dependence and overuse under projected climate change scenarios

- While all climate models agree that Yemen will face hotter temperatures under any emissions scenario by mid-century (World Bank, 2023a; Alvar-Beltrean, 2023), trends in future precipitation are more difficult to discern owing to disagreements over model results and high variance across topographic and climatic zones within the country. The disagreements mainly concern the direction of change – either increasing or decreasing rainfall.
- FAO, using CORDEX CORE CMIP5 projections, shows an annual precipitation reduction of –20 to –40 mm under the RCP8.5 scenario (high emissions) along the Red Sea coastline (including part of Taizz) and the highlands (including part of Hadhramaut) region by 2040–2069 compared to 1976–2005. Under the RCP2.6 scenario (low emission), the model simulates an increase of +40 mm to +60 mm in the same region over the same period (Alvar-Beltrean, 2023).
- More recent World Bank projections using CMIP6 under SSP3-7.0 (high emissions scenario) show median precipitation increasing by 2.76% by 2040–2059 compared to 1995–2014, with a –3.78% and 18.85% variance for the 10th and 90th percentile estimates. Median changes in precipitation are projected at 6.61% (–9.08%, 39.31%) for Taizz and 1.39% (–1.73%, 10.72%) for Hadhramaut (World Bank, 2023a). Despite uncertainty in median temperatures and precipitations, extreme heat (days >35°C, tropical nights > 20°C) and precipitation (largest five-day precipitation amounts over 10-, 25-, 50- and 100-year events) are all projected to increase considerably under most scenarios across Yemen (World Bank, 2023a). For instance, even under SSP2 – 4.5 (a central scenario representing the current global emissions pathway) extreme hot days (>30°C) will increase from a median of 217.30 days to 262.45 days in Taizz and from 245.45 days to 273 days in Hadhramaut between the 1995–2024 period and the 2040–2059 period. Extreme hot nights will increase from a median of 246.39 to 279.24 nights in Taizz, and from 188.15 to 217.67 nights in Hadhramaut over the same two time periods (World Bank Group, n.d.). This will translate to more intense and prolonged droughts and stronger flooding.
- Under current trends, the risk of complete groundwater reserve depletion is high even without climate change (Abo-Thrais et al., 2025; RCCC, 2024). However, higher temperatures and more intense droughts are expected to increase evaporation and runoff, worsening groundwater recharge. Similarly, heavier rainfall and flooding may damage water infrastructure, hampering water infiltration. In the coastal areas, projected sea-level rise will worsen saltwater intrusion into local aquifers and diminish drinking water availability, affecting particularly the Tuban and Abyan deltas (Alvar-Beltrean, 2023).
- Even under a scenario of increased future precipitation, without targeted investments and rehabilitation of water storage (both natural and built) and measures to address the drivers of groundwater depletion, the impacts of more intense rainfall and longer dry spells will have critical consequences for water security.

3.3.2 Maladaptive agricultural and fishing practices

Yemen's agricultural sector operates under severe structural constraints. Less than 3% of the country's territory is arable, while 85.4% is inherently unusable because it comprises rock, desert, and sand dunes. On top of this, 12.5% of land is already degraded through erosion, salinisation, or soil crusting (CSO, 2025).

Both the literature (see for example World Bank, 2010; Muharram and Alsharjabi, 2019) and interviews confirm a long-term shift away from rainfed agriculture. Terraces and *karfaan* basins, once vital to retain rainwater, have been abandoned owing to rural–urban migration, invasive plants, and neglect. Even rainwater harvesting is increasingly unreliable, with a respondent in Hadhramaut pointing to shifts in the rainfall calendar.

The 'random' nature of resource use in Yemen goes beyond well digging. During interviews, this term was also repeatedly used to describe new fishing practices and the use of pesticides and fertilisers. Respondents stressed the negative impacts of these practices on the environment and the lack of government control that allows their use to proliferate.

The literature and interviews confirm that Yemen's agri-food sector is maladaptive, not only in the way food is produced but also in the way it is consumed. As noted earlier, national food security is dependent on imports as a result of policies introduced since the 1970s. Food trade is concentrated in the private sector, with few government mechanisms existing to hedge sector-level risks. This leaves Yemeni households highly vulnerable to exogenous shocks, in a context where coping capacities are already stretched to their utmost.

The most important example of this is the depreciation of the Yemeni Rial (YER), with the current food security crisis best characterised as a food affordability crisis. It is notable that the monitoring of risk alerts by ACATS focuses almost entirely on currency risk, with drought a distant second and conflict a still more distant third.

The dependence on a narrow base of cash crops exported to a small number of countries means that livelihoods are highly vulnerable to shifts in the policy environment, with effects seen when Saudi Arabia held back onion exports from Hadhramaut in 2024–2025. While this amounts to a rounding error for Saudi imports overall (<0.001%), nearly all respondents in Hadhramaut felt that it had substantially affected the primary sector.

A further consequence is that one of the most important dimensions of climate risk for Yemeni households is extra-territorial; namely, climate-linked spikes in global commodity prices. The experience with the Ukraine war suggests that short-term fluctuations of 25–30% are possible based on conditions with a single major exporter.

a Taizz

In 2023, Taizz had 73,300 hectares of cultivated crops, representing 5.8% of the governorate's land area (CSO, 2025). Much of this agricultural activity is dominated by *qat* cultivation. Between 2016 and 2021, cultivated *qat* area expanded sharply across the country, with a median increase of 80% across nine governorates (World Bank, 2023a). Taizz is now considered the epicentre of this trend, reportedly producing 65% of Yemen's *qat* in 2022–2023, though this figure should be treated with

caution given agriculture production data reliability²¹ issues (CSO, 2025). Respondents explained that this expansion has been driven by rising input costs, particularly fuel and water, linked to the depreciation of the Rial and the disruption of input markets. These effectively make *qat* cultivation the only viable agricultural livelihood. The environmental consequences of *qat*'s expansion are severe: the crop consumes about 40% of Yemen's potable water, accelerating groundwater depletion and displacing other food and cash crops (Almas and Scholz, 2006). Anecdotally, respondents suggested that this trend accelerated between 2021 and 2025.

b Hadhramaut

In 2023 Hadhramaut had 43,909 hectares of cultivated crops, representing just 0.2% of the governorate's land area (CSO, 2025). Agricultural production in the region relies heavily on diesel-powered irrigation; Hadhramaut's diesel consumption for irrigated crops is four times the national average, reflecting both dependence on this method and the likelihood of diesel smuggling (Al-Weshali et al., 2015). Poorer farmers, particularly those cultivating fodder and vegetables, are most vulnerable to diesel price spikes and shortages, while those growing drought-tolerant crops, producing *qat*, or using alternative water sources such as floodwater are better able to cope (ibid). Respondents described a sharp increase in costs over the past four to five years; a 100% increase in water cost, transportation cost, and storage cost was cited.²² This has forced many farmers to reduce cultivation, deepen wells, or abandon land, sometimes converting it for residential use. These changes can have lasting environmental impacts through desertification, dumping of solid and liquid waste, invasive species, and the deterioration of rainfed irrigation infrastructure. As in Taizz, respondents reported an increase in cash crops to cover rising input costs linked to currency depreciation, making earning a livelihood even more complex.

Poverty has driven households to exploit resources unsustainably. 'The most important driver for these changes is poverty, which has pushed many people to deplete fish wealth, and to find illegal methods in random and destructive fishing.'²³ Interviews with the General Authority for Environmental Protection confirmed that current fishing practices are maladaptive; unregulated gear and seasons, weak monitoring, and indiscriminate catching of juveniles and spawning females are depleting stocks, despite the export ban. Traditional cross-regional seasonal coordination (Hadhramaut–Al-Mahra–Socotra–Somalia) has unravelled, while rising fuel costs and the diversion of sardines/anchovies to fish-grinding companies have squeezed local supply and driven prices beyond many coastal households' reach. Tougher sea conditions, underpowered boats, and interception by offshore fleets further reduce near-shore catches. According to the Authority, these outcomes stem from enforcement gaps rather than the absence of rules.

21 There is no systematic land registration in most of the country, making it impossible to reliably determine landholding sizes or the distribution of ownership and tenancy.

22 Interview H#03.

23 Interview H#03

Box 2: Maladaptive agricultural and fishing practices under projected climate change scenarios

- Based on projected temperatures and precipitation (see Box 1), climate change has the potential to further exacerbate existing food insecurity and the impacts of maladaptive agricultural and fishing practices in Yemen.
- Projected increases in air- and heat stress during both day and night can cause the exceedance of critical thresholds for crop pollination, downregulate photosynthesis and carbon allocation to plants and seeds, and reduce biomass, especially for food crops. These all lead to reduced agricultural yields. Similarly, an increased frequency and intensity of dry spells can lead to crop failure during key growing phases (Alvar-Beltrean, 2023).
- Under scenarios of increased and erratic heavy precipitation, soil erosion, leaching of macronutrients and degradation of soil fertility may lower agricultural yields. At the same time, a wetter climate will also favour desert locust breeding (Alvar-Beltrean, 2023).
- Projected sea surface temperature increases may result in fish migration, especially of commercially valuable fish species, and sea acidification may increase juvenile mortality. Projected sea-level rise may also increase risk to fishery assets and property, including landing sites and ice and storage sites (Alvar-Beltrean, 2023). The World Bank estimates decreases in maximum fish catchment under climate RCP2.6 and RCP8.5 scenarios to be -16.6% and -23.1%, respectively, by 2041–2050, corresponding to 1% of GDP (World Bank, 2024: 38–39).
- Projected temperatures and rainfall anomalies will also affect groundwater recharge and availability in Yemen, which is central to agricultural production. The World Bank projects that if the groundwater recharge rate were to be half the historical 4–5%, then the annual unmet irrigation water demand will grow from 40+% to almost 60% in 2041–2050 under most climate scenarios. Under historical recharge rates, estimated unmet irrigation demand will range from 30% to 40% (World Bank Group, 2024: 30).

3.3.3 Degradation of water, air, wetlands and health

Yemen faces intertwined land and water degradation challenges, driven by population growth, urbanisation, and agricultural expansion. Vegetation loss and soil degradation threaten agricultural sustainability and increase vulnerability to climate hazards (Almeshreki et al., 2012). At the same time, soil pollution (by wastes, fertilisers or polluted water) exacerbates water scarcity by reducing natural recharge, clogging soil pores and altering groundwater flows (Naser et al., 2018).

Water pollution in Yemen affects access to clean drinking water, access to irrigation water for agriculture, and the preservation of maritime and coastal areas. In particular, wetlands and estuaries are vital but fragile ecosystems and sources of livelihood. They are under additional pressure from drought, overfishing, mangrove cutting and overgrazing (Al-Mahfadi, 2020). The loss of wetlands reduces the essential ecosystem services of flood control, groundwater recharge, water purification, biodiversity and climate regulation.

a. Taizz

Apart from a few upper reaches of streams and Wadi Ad Dabaab, most watercourses that flow for more than six months a year are heavily polluted (Handley, 2017). Groundwater, a critical source

of drinking water, is widely contaminated and often unfit for consumption (Naser et al., 2018). This contamination arises not only from human activity, such as unmanaged solid and liquid waste, but also from structural factors. For instance, the region's volcanic and basement geology naturally releases fluoride, while low rainfall, high temperatures, and intense evaporation further concentrate fluorides and salts in shallow aquifers (Al-Amry, 2009; Aqeel, Al-Amry and Alharbi, 2017). Communities that rely on wells, particularly children and low-income households, are exposed to significant health risks, including dental and skeletal fluorosis and kidney dysfunction (ibid).

In Taizz, the collapse of water and sanitation services has polluted water sources, farmland, and wetlands. With only 38% sewer coverage in urban areas (vs. 44% nationally) and open defecation in some districts, untreated wastewater contaminates groundwater and storage tanks (Oxfam, 2015; GIZ, 2021). Rains then spread sewage and solid waste across fields and wetlands (Zabara and Zumbrägel, 2022). Fuel and salary shortages cripple waste collection, causing garbage accumulation and, in rural areas, open burning, driving air pollution and respiratory risks (UN-Habitat, 2020; Zabara and Zumbrägel, 2022). These conditions degrade ecosystems and heighten health risks. Contaminated water fuels cholera, unhygienic environments contribute to leishmaniasis, and stagnant water from poor drainage and waste creates breeding sites for dengue vectors. These illnesses compound malnutrition, especially among children and pregnant women (Alyousefi et al., 2016; Zabara and Zumbrägel, 2022).

b. Hadhramaut

In Wadi Hadhramaut, land and water pollution from human activities poses significant, long-term, and region-wide risks as contaminated water flows south, spreading pollutants across soils and water systems. Agriculture, livestock and forestry livelihoods, including crop cultivation with fertilisers and chemicals, livestock management, and tree cutting, have degraded soils, reduced agricultural productivity, limited fodder for livestock, and deprived beekeepers of valuable tree species (Lackner, 2021).

Large-scale industrial activities, particularly in the oil sector, further exacerbate these pressures on livelihoods and health (al-Eryani, 2020; Lackner, 2020). Although oil exports have been curbed by the conflict,²⁴ several state-run firms continued extraction in 2020 – not because of high returns, which remain limited, but because of the sector's role in sustaining dependent services such as transport, security, and water management (al-Eryani, 2020). Oil companies contribute to environmental degradation through the release of untreated water (e.g., 2 million barrels/day in Block 14), high-salinity water disposal, injection near aquifers, poor industrial waste management, neglected well maintenance, faulty casings, and gas flaring (al-Eryani, 2020). Floods amplify these risks, spreading hydrocarbons over long distances and threatening agriculture, livestock, ecosystems, and communities far beyond the oilfields. Generally, those who suffer the effects of this environmental damage receive no compensation and have no legal recourse (al-Eryani, 2020; Lackner, 2020; 2021).

Environmental changes further compound these challenges. Invasive species such as mesquite and prickly pear replace native grasses and shrubs, reducing pasture quality and livestock health (Almeshreki et al., 2012). Traditional clay terraces, once essential for soil retention and water management, are damaged or overtaken by invasive plants, increasing erosion, reducing

²⁴ See, <https://sanaacenter.org/the-yemen-review/november-2022/19204>

groundwater recharge, and weakening soil fertility. Yemen's arid climate and irregular rainfall intensify these effects, in that prolonged dry seasons limit regeneration and favour invasive species, while episodic floods erode topsoil in weakened terrace areas (ibid).

In coastal Hadhramaut, ecosystems and livelihoods face additional pressures. The salinisation of springs, streams, and wells is worsening owing to cyclones, early signs of sea-level rise, and overextraction from coastal aquifers (Lackner, 2021). Fishing communities are further affected by oil pollution from ships, as lubricant waste spreads along the coast, killing fish and contaminating feeding grounds (Lackner, 2021). Large trawlers operating close to shore intensify the damage by overfishing and scraping the seabed, which destroys coral reefs and fish habitats (ibid). These combined pressures also threaten mangroves and other coastal ecosystems that are vital for marine resources, biodiversity, and livelihoods.

Box 3: Degradation of water, land and health under projected climate change

- The Red Sea and Gulf of Aden mangrove ecosystems were estimated to cover 189.2 km² in 2020. They are classified as *endangered*, having declined by 21.7% since 1996. Approximately 1.7% of this ecosystem is currently degraded, with projections suggesting an increase to 5.2% within 50 years based on vegetation index decay analysis (2024). Under a high sea-level rise scenario (RCP8.5), as much as 67.1% of the region's mangroves could be submerged by 2060 (Alvar-Beltrán, 2023).
- Malnutrition and waterborne diseases in Yemen are intimately linked to drought, poor sanitation, and limited clean water access. The compounding effects of climate change are expected to further strain an already fragile health system. With changes in projected precipitation patterns, waterborne diseases are expected to worsen. The World Bank estimates an additional 1.1 million diarrhoea cases attributable to climate change by 2050, resulting in over 200 additional deaths and USD 156 million in excess health costs under the SSP3-7.0 scenario (World Bank, 2024).
- The incidence and prevalence of vector-borne diseases, particularly malaria and dengue, are projected to rise as changing temperatures and precipitation patterns expand transmission zones. Global spatial modelling by Colón-González et al. (in World Bank, 2024) estimates that by 2040–2069, approximately 40 million people in Yemen could be at risk of dengue and 25 million at risk of malaria, compared to 6.2 million and 4.7 million respectively during 1970–1999. This increase reflects longer annual transmission seasons under both SSP2-4.5 and SSP5-8.5 scenarios.

3.3.4 Unaddressed extreme weather events

Taizz and Hadhramaut are exposed to a variety of extreme weather events associated with storms, droughts, flash floods, and heatwaves. These hazards already have severe impacts on communities, agriculture, and infrastructure, destroying homes and farmland, displacing families, disrupting livelihoods, and causing fatalities (Aklan, 2024). Although data is limited and must be treated with caution, available evidence suggests that these events are becoming more frequent and intense. Rising temperatures and changing rainfall patterns are expected to increase drought and desertification, compounded by overextraction of groundwater for irrigation. More severe storms threaten coastal areas, while flash floods already cause major damage as water runs off into the desert without recharging depleted aquifers. Flooding hazards, including pluvial, fluvial, and coastal floods, are projected to intensify. By 2050, around 5.3 million people could be exposed to floodwater depths of at least 15 cm during a 1-in-100-year

event, with exposure concentrated in densely populated districts (World Bank, 2024). Poor land-use practices – deforestation, unplanned urban development, and weakened terraces – amplify these flood impacts.

Floods

Flooding is currently the type of sudden-onset hazard with the highest risks for communities and ecosystems, particularly in Taizz and Hadhramaut (Aklan, 2024).

In Taizz, densely populated mountainous areas experience highly variable rainfall, ranging between 200 and 600 mm annually with pronounced monsoonal peaks in April–May and August–September. Recent years have seen extreme rainfall anomalies, such as 10-day totals of 90 mm in 2022 instead of the expected 25 mm, causing flash floods that damage terraces, canals, roads, and wells while contaminating groundwater and destroying crops (World Bank, 2024a; Aklan, 2024).

In Hadhramaut, the sparsely populated desert and coastal areas receive less than 50 mm of rain annually, yet are highly exposed to cyclones and flash floods from wadis. Rapid urban expansion, informal settlements along wadi beds, blocked watercourses, and limited stormwater management further heighten flood risks (Lackner, 2021). Flood events have repeatedly eroded terraces, silted canals, destroyed irrigation infrastructure and houses (especially traditional mud houses in the valley and IDP shelters), submerged plantations, and buried wells. These disasters disrupt mobility, with 0.9–2.3 million people in Taizz and Hadhramaut projected to face flood-related connectivity disruptions from a 1-in-200-year flood by 2050 (World Bank, 2024a). Hadhramaut is particularly vulnerable owing to sparse road networks and population concentration in a few cities, limiting connections to the rest of Yemen. These factors, in addition to sea-level rise and ocean acidification, put the urban area of Al-Mukalla at great risk of erosion and floods that endanger coastal systems (infrastructure, housing, livelihoods, coastal resources, etc.) (Republic of Yemen, 2018).

Communities cope through distress strategies: farmers sell livestock, pastoralists lose herds, labourers lose contracts and wages, and women and children spend more time securing water and food. Limited income diversification, especially among women-headed households, slows recovery and increases vulnerability.

Drought and extreme heat

Yemen's arid and semi-arid environment is characterised by high temperatures and low rainfall, strongly influenced by topography. Between 1971 and 2020, mean annual temperatures increased by 0.42°C per decade, accompanied by a growing number of hot and humid days and nights (World Bank, 2024a). An estimated 7.2 million people are exposed to extreme heat, particularly along the western and southern coastal plains, and the coastal areas of Taizz and Hadhramaut. Coastal cities like Al-Mukalla already experience heatwaves that threaten outdoor workers (60% of Yemen's population) and internally displaced persons (Republic of Yemen, 2018; World Bank, 2024a). Illnesses linked to extreme heat are projected to increase tenfold between 2020 and 2050, with 25% of cases directly attributable to climate change (ibid). Women (particularly pregnant women) and elderly people are expected to suffer the most from heat stress related diseases (Republic of Yemen, 2018).



Photo by Khojjakbar Teshaboev

4

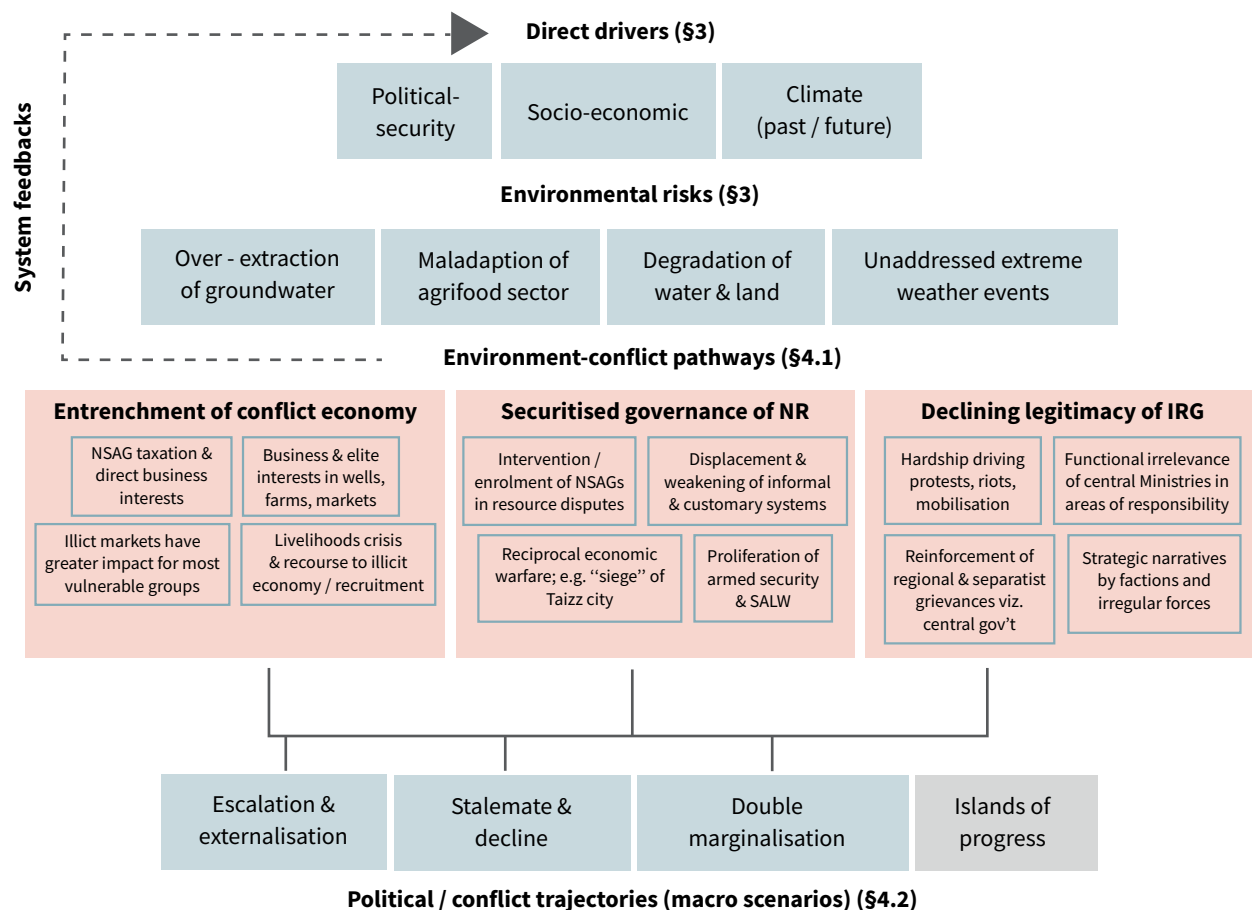
Environment, climate and conflict risks

This section builds on the foregoing situation analysis for Taizz and Hadhramaut, by discussing the specific interactions between environmental risks and conflict risks (see Figure 7). It breaks down the interactions between the environmental risks identified in Section 3.3 and three conflict pathways, namely:

- i. the further entrenchment of the conflict economy;
- ii. the securitisation of resource governance; and
- iii. challenges to IRG legitimacy.

It also considers how these environment–conflict pathways may play out on a longer timeframe and at a larger scale through macro scenarios of political and conflict trajectories, and what this means for high-level HMG goals in Yemen (Section 4.2 below).

Figure 7: Overview of environment–conflict pathways



4.1 Conflict pathways

4.1.1 Entrenchment of the conflict economy

Most sources agree that Yemen’s licit economy is in freefall, with an estimated 50% decline in GDP per capita since 2014. This has had profound consequences at the community level. A 2023 survey by the European Institute of Peace found that 97% of respondents identified ‘lack of economic opportunities, unemployment and increasing poverty’ as a problem (Garcia et al., 2024: 26).

In this context, it has been argued that recruitment into irregular armed forces represents one of the very few viable livelihood options (Barry et al., 2024: 16; Garcia et al., 2024: 26). Such recruitment dynamics are closely tied to the broader livelihoods and food security crisis. Several of our interviewees agreed this was something that they had observed in Taizz.²⁵ Respondents in Hadhramaut noted that the same motivation can apply to enlistment in state security forces, because they can ‘pay in hard currency and large sums to attract unemployed youth.’²⁶ In practice, it is likely that the latter includes the Tribal Alliance and Hadhrami Elite Forces, and not solely the regular security forces.

²⁵ Interview T#13, T#20.

²⁶ Interview H#13.

The broader picture that emerged in both governorates is of a context that is simultaneously generating both crisis and opportunity, as with all wartime economies (Goodhand 2004; Ballentine and Nitzschke, 2005). The foremost pathway in this regard is the economic sustainment of political/military factions.

One mainstream source, the World Bank's country economic memorandum of 2022, states that 'all factions use a mix of coercive economic tools to improve their economic positions and weaken their rivals' (World Bank, 2023: 89). For most of Yemen – outside of oil-producing areas and the rival capitals of Sana'a and Aden – the vast majority of these 'tools' relate to the primary sector, water resources, and the internal/external markets that are linked to them.

More indirectly, this wartime economy is also transforming social and economic roles at the community level, especially for vulnerable groups (notably women, IDPs, and youth). Alongside a general increase in their vulnerability, members of these groups are taking on new economic roles and asserting emerging forms of leadership and innovation. Much of this innovation is economic in nature, rooted in greater involvement in income generation, resource management, and household decision-making. This has expanded their visibility and influence in community structures. As one respondent said:²⁷

'Many women have been rehabilitated, and many pioneers and entrepreneurs have emerged in women's businesses after their exposure to climate change crises. Instead of relying primarily on men as breadwinners, their thinking has completely changed. Many women entrepreneurs have emerged, exploring other professions and sharing responsibilities within the household. The same approach applied to youth encouraged change, creating opportunities and distributing family responsibilities among more than one individual.'

a **Taizz**

In Taizz, these dynamics are particularly significant, with the governorate characterised by multiple 'internal frontiers', stable Houthi control of the industrial north and main roads, and an unstable coalition of security/political actors in IRG-controlled areas (see Section 3.1). A first recurring theme among interviewees was the part-ownership or de facto control of water sources by specific factions.²⁸ As one respondent in the water sector put it, 'The influential leaders are those who control all the resources; government or non-government security forces support the control of the influential.'²⁹ Allowing for translation from the original Arabic, this has an interesting double meaning; that elites tend to control resources outside of formal institutions, and also that they are elites precisely *because* they control resources. The specific reference, we can plausibly assume, is to regional forces aligned with the Islah party, STC and Tariq Saleh (Salisbury, 2017; Jautz, Basalma and Rogers, 2022; Barry et al., 2024).

²⁷ Interview H#2.

²⁸ Interviews T#03 T#04 T#05 T#06 T#10 T#11 T#13 T#15 T#18.

²⁹ Interview T#13.

In this regard the governorate-level trend may be described as the displacement of water governance away from public and customary systems, and towards private actors. This has sometimes occurred in a very literal sense; several interviewees noted that ‘military and influential parties have looted the water corporation’s equipment and stores in the previous period’.³⁰ However, the more significant dynamic is the proliferation of unregulated borehole drilling or expansion (Schmitz, 2012; World Bank, 2023b; Abo-Thrais et al., 2025). This was described by many interviewees as a kind of ‘chaos’ or ‘anarchy’, in the sense of completely escaping regulation or control. This situation leads to:

- social externalities, where reliance on solar-powered systems has largely excluded smallholder farms and favoured actors with greater financial resources and ties to security forces (Aklan and Lackner, 2021);
- environmental externalities – above all, the depletion of groundwater – with implications for the sustainability of all related infrastructure, as well as soil and water pollution; and
- sizeable economic rents, i.e., returns above transfer earnings,³¹ for actors with the financial or military capacities to assert control over water resources.

The energy market has changed in similar ways. Several interviews highlighted the displacement of public supply by a shadow electricity market controlled by armed groups and security forces in cities, or private sector actors with murky ownership interests. In Taizz city, the shadow electricity market operates through individuals known as *as-hab mawateer* (motor owners), who sell power from private generators at inflated prices, often ten times the public service rate. These vendors sometimes establish monopoly zones, forcing businesses and households to pay high fees to remain operational. The local Electricity Corporation tacitly permits these arrangements, even relying on them for street lighting (UN-Habitat, 2020).

A third major contributor to the sustainment of political-military factions is the control and taxation of roads and markets. Interviewees provided examples of how and where taxes are levied and movements are restricted by a range of different factions.³² This affects prices for both inputs (fuel, water) and outputs (cash crops) of agriculture across Taizz. This naturally affects the functioning of the entire agri-food sector, which depends upon the import of most of the consumed calories (see Section 3.3 above). In this overall context, there are clear limits to the effectiveness of local-level initiatives to renegotiate access to roads, land and water. This is especially clear in Houthi-controlled areas,³³ where taxes on the primary sector and markets are thought to account for the bulk of the group’s revenues (Rogers, 2020; International Crisis Group, 2022).

These economic and security dynamics shape not only the balance of power but also everyday survival strategies. In Taizz, especially in rural areas, livelihood options beyond agriculture remain limited. Most respondents nonetheless recognised positive changes associated with women and youth taking on new economic roles.³⁴ In agriculture and livestock farming, women have assumed tasks abandoned by men who have shifted to export crops, gaining knowledge in climate-sensitive techniques, and introducing innovations such as improved irrigation and

³⁰ Interviews T#15; T#19.

³¹ The rate of return required to keep natural resources allocated to their current use, rather than redirecting them to another use.

³² Interview T#02 T#03 T#04 T#15 T#18.

³³ Interview T#08, T#10.

³⁴ See Section 3.1 for illustrative cases of women’s and youth’s political participation in peacebuilding. These instances are indicative rather than comprehensive, as this report addresses this topic only tangentially.

greenhouses. Some women have also found opportunities outside agriculture, in sectors such as handicrafts, small-scale services, or food processing.

These activities represent important social changes as vulnerable groups take up new roles, showing creativity and initiative in the face of crisis. However, it is important to note – out of analytical caution rather than based on respondents’ views – that these shifts should be seen as socially transformative but economically fragile, given the health risks of outdoor work during heatwaves, the persistent difficulties facing the agricultural sector, and the limited reach of industrial opportunities beyond a few urban areas of Taizz (see Table 3 below). In some cases they may also be associated with increased risks of inter-personal violence, given the high level of daily exposure to illicit markets and insecure environments.

Table 3: The livelihoods of women and youth in Taizz

Emerging livelihoods	Group	Positive outcomes	Negative outcomes
Agriculture and livestock (e.g., sale of products, home gardens)	Women and youth in rural Taizz	Greater decision-making power and visible influence; adoption of climate-resilient agricultural practices	Physically demanding work with health risks (heatwaves), exposure to security threats (armed groups, landmines), no land ownership for women, low wages.
Handicrafts (e.g., knitting, engraving)	Women in urban and rural Taizz	Offers limited financial independence, often complementing other income-generating activities	Limited medium-term sustainability owing to market demand; restricted capacity for decision-making or influence.
Small- or medium-sized enterprises (e.g., cosmetics, tailoring, food processing such as cheese and yogurt)	Women in urban Taizz	Generates moderately sustainable incomes, with potential for longer-term economic contribution, depending on local conditions	Largely urban-focused; dependent on local market conditions.

Source: Interviews for this research

b Hadhramaut

In Hadhramaut the direct sustainment of non-state armed groups is less prominent, although this dynamic still exists. The more obvious challenge is the disruption and maladaptation of the primary sector to accommodate a dysfunctional status quo of state withdrawal, fiscal and monetary collapse, and inconsistent access to internal and external markets. The most prominent trends in Hadhramaut include the scale-back, abandonment or conversion of agricultural land that is unproductive under current constraints; the proliferation of unregulated private wells (as in Taizz); the corresponding decline of rainfed irrigation and deterioration of related infrastructure; and unrestricted and unsustainable fishing beyond historical boundaries.

These challenges in the primary sector strongly shape overall livelihood options in this predominantly rural governorate. Respondents mentioned a widespread loss of agricultural jobs and very few livelihood options outside the sector. Half the respondents noted, often in indirect ways, that women and youth are beginning to rely less on men as sole breadwinners.³⁵ However, references to entrepreneurship or leadership among women and youth were less frequent than in Taizz. Women's participation in agricultural work or short-term programmes such as cash-for-work initiatives was described primarily as a last-resort strategy to support households where men are unemployed or in single-headed households, rather than as a pathway to economic autonomy.³⁶

The significance for conflict dynamics is that there are now business, tribal, and factional interests in natural resources governance to contend with, and corresponding costs in reversing these (mal-) adaptations. Initiatives to restructure and regulate the water sector, for example, must expect to encounter resistance that is proportionate to vested interests. This may be referred to as 'transition risk' for climate adaptation or environmental governance initiatives.

An important system-level feedback is that some changes may be very difficult to reverse, largely owing to features of the underlying ecological systems. The most critical of these is the steady retreat of the water table, which will progressively move below the reach of current infrastructure. Currently, there are no practical options to support faster recharge of aquifers. In this sense there are emerging 'hard limits' to adaptation based on the limits of hydrological systems. Other trends that may be unfeasibly costly to reverse include the desertification that follows land abandonment and the decline of irrigation infrastructure through physical disrepair and the proliferation of the invasive species mesquite (*N. juliflora*).

c Links to macro scenarios

Understanding the dynamics of the conflict economy is essential to understanding the political and economic situation in Yemen. A first point is that political fragmentation depends upon, and is encouraged by, regional political economies. This is most obvious in Houthi-controlled areas, where the taxation of agriculture and trade is increasingly formalised and accompanies the restructuring of local governance (Rogers, 2020). However, the dynamics are equally important in the IRG-controlled areas discussed in this paper, where the direct and indirect economic interests of regional factions afford them a great deal of autonomy from both the central government and (where relevant) their foreign sponsors.

A second key point is that efforts to strengthen climate adaptation or environmental governance must grapple with a complex stakeholder landscape. It will be extremely challenging for such initiatives to find a neutral entry point or 'win-win' solutions, given the level of entrenched business interests and their close relationship with regional political factions and armed groups. Therefore, it must be assumed that there is a high level of transition risk associated with reform initiatives, however optimal they may be on paper.

A third key point is that there are obvious historical examples in 1994, 2011 and 2014 when daily hardships and the collapse of basic services triggered national-scale protests (see Section 3.1). In this context, it is impossible to predict how the present tempo of protests and riots in both governorates will evolve, accounting for a good amount of 'nudging' by different factions.

³⁵ Interviews H#04, H#06, H#08, H#09, H#11, H#13, H#14, H#15, H#20.

³⁶ Interviews H#02, H#04, H#06, H#08, H#14, H#15.

4.1.2 Securitisation of resource governance

There is undoubtedly a considerable amount of community-level conflict over natural resources. A 2023 survey by the European Institute of Peace found that 70% of respondents had encountered or heard about conflict linked to the environment or natural resources (Garcia et al., 2024: 29). The most commonly cited issues were ‘access, control and capture’ (40%), and then ‘resource management practices’ (24%). The most commonly mentioned sources of conflict were competition over water (69%) and competition over gas/oil/energy (63%). This aligns with secondary research estimating that 70%–80% of rural disputes concern water, water management networks, and infrastructure (UNDP/FAO, 2023: 21).

Interviewees echoed these high-level trends, noting that ‘we now have continuous conflict over water wells’ and that ‘most of the killing incidents were due to conflict over water’.³⁷ An important corollary is that this was seen as an intensification of a much longer history of community-level conflicts over water sources and *awqaf* lands, including unlawful land seizures (Schmitz, 2012; al-Mowafak, 2021). Positioned on this longer timeline, conflict over water and land resources does not necessarily reflect inter-communal tensions enflamed by a sectarian or inter-tribal war, but are rather ‘local and caused in part by people themselves, [and] victims and perpetrators are often found within the same community’ (Lackner, 2021). The key dynamic in this regard is the ongoing structural transformation of the agriculture and water sectors (see Section 3.3). The overall tenor of interviews was not so much that norms and customary practices were breaking down, but rather that they were being overtaken by events in a changed landscape of use practices and stakeholder incentives.

a Taizz

In Taizz there have been several notable escalations and transformations of inter-communal resource conflicts. Our interviewees felt it was common for both regular forces³⁸ and irregular forces³⁹ to intervene in disputes over wells, land use, energy, and transport. To a large extent, these forces have replaced customary mechanisms for distribution and arbitration, such as the *harim* limitations on boring of new wells (a kind of minimum distance requirement). One interviewee described armed groups employing ‘state tools to regulate the electricity and fuel market’, and gave an example where ‘private sector traders turned to selling poor-quality solar energy products, which led to the intervention of armed groups and security forces to impose procedures and levies on traders that led to rising prices’.

A related phenomenon is the increasingly widespread use of armed security amidst a proliferation of small arms and light weapons.⁴⁰ As one interviewee explained, ‘In most commercial businesses, whether in buying land or practising a trade that generates income, such as exchange and gold, you need armed men.’⁴¹

At a larger scale, fighting along the ‘internal frontiers’ of Taizz is often targeted around key road routes and supply chains (Abo-Thrais et al., 2025). This dynamic replicates in miniature the experience at national level, where major battles have frequently focused on ports and trade routes (World Bank, 2018; Murugani et al., 2021; International Crisis Group, 2022). The most high-

37 Interviews T#17, T#08.

38 Interviews T#03 T#09 T#10 T#13.

39 Interview T#03 T#04 T#06 T#11 T#12 T#13.

40 Interviews T#06 T#08 T#13 T#15.

41 Interviews T#13.

profile case in the governorate has been the tactical restriction of water supply in Taizz city by Houthi-aligned forces in and around al-Hawban. Interviewees stressed that a much-publicised agreement between the respective local water and sanitation corporations to re-open access to wells and water basins in Houthi-controlled territory has not yet translated to facts on the ground, and that it was common for armed groups to tout such initiatives and progress for an international audience.⁴²

This accompanies a well-documented level of damage to essential transport and water infrastructure, and ‘crowding-out’ of maintenance and investment. A conventional estimate is that 40% of the water and sanitation sector infrastructure, nationally, has been damaged (Omar, 2025; Abo-Thrais et al., 2025).

One corollary of security actors’ increased involvement is that civil institutions are pushed to the margins. At a practical level, it is extremely difficult to regulate the highly dispersed extraction of borehole water and the re-purposing of agricultural land (even before considering the protagonists’ ties to armed groups). Research by the European Institute of Peace found that just 23% of respondents in Taizz said they were aware of ‘formal environmental policies or laws’, and 30% were aware of ‘entities available at a local level to approach about environmental issues’. Interview feedback noted that the effectiveness of customary institutions for resource governance was uneven, and depended upon the strength of community pressure.

b Hadhramaut

In Hadhramaut, these dynamics were less prominent. We were given some examples of local-level conflict over rainwater harvesting and irrigation (e.g., in Rawabi), but heard generally more positive perceptions of community-led mechanisms such as the *gheil* system for flood irrigation. Among most interviewees, there was a cautiously optimistic view of customary institutions, to the effect that ‘they alleviate a lot of pressure on courts and local authorities, and resolve problems at their inception’.⁴³

c Links to macro scenarios

Overall, one can expect a steady level of local-level conflict over the use and management of natural resources, at somewhat lower levels in Hadhramaut than in Taizz. Alongside this it is important to keep in view a number of potential consequences beyond the local and inter-communal level. Since 2014, the national conflict has been punctuated by recurrent economic warfare over control of ports, roads and shipping, with the conditions of the Tazz ‘siege’ being a specific point of contestation. The broader dynamic of scuffling along ‘internal frontiers’ in Taizz over the control of key roads and access to land and water represents both a consistent lower-level security threat and a potential destabilising factor in the wider conflict.

In Hadhramaut the lower incidence of these issues may reflect relatively stable coastal and interior ‘zones of control’ rather than the absence of the underlying dynamics. In both governorates it is important to be aware that vulnerable groups are often forced to act in securitised resource environments. This applies to IDPs seeking access to land and informal livelihoods and many women, who are primarily responsible for household water collection.

⁴² Interviews T#01 T#15.

⁴³ Interviews H#04.

4.1.3 Decline of IRG legitimacy

One of the most consistent points of feedback was that the dynamics mentioned above are not new; as one interviewee put it, ‘Everything mentioned was present at the beginning of the war.’⁴⁴ In this sense contemporary dynamics are echoing and reinforcing historical grievances about the inclusivity, capacities and behaviours of the central government.

One such grievance concerns patronage or co-optation in the water and agriculture sectors, especially at central government level. This has been observed since the 1970s, with the result that relationship between ‘private’ and ‘public’ interests has always been complex, if not completely illusory (Huntjens et al., 2014; Mundy, 2017; Varisco, 2019). The fine details of these relationships have been examined in studies on the evolution of the agriculture sector (UNDP, 2024b) and on groundwater abstraction as a development strategy (Huntjens et al., 2014). Their political effects are evident in multiple areas including:

- the discourse around the ‘Southern question’, in which access to land and water has often been specifically problematised (International Crisis Group, 2011; Arraf, 2017; Konrad Adenauer Stiftung, 2019);
- widespread public protests in 1994, 2008–2009, 2011 and 2013–2014, in which the prices of commodities were inciting issues; and
- the adoption of these narratives by parties in the national conflict, including the Houthi movement and the Southern Transitional Council (International Crisis Group, 2011; Arraf, 2017).

At the outbreak of the national conflict in 2014 these issues were far from resolved. One representative summary was that ‘The political transition ended in elite bargain rather than regime change and thus addressed neither socio-economic grievances nor the political crisis’ (SIPRI, 2021: 25). In fact, before the start of the national conflict it was estimated that 40% of the population was already food insecure (i.e., in the IPC ‘emergency’ or ‘crisis’ phases), compared to 52% at the time of writing this report (IPC, 2014; IPC, 2025).

Events in the past decade have further entrenched these grievances. The conflict has seen a substantial hollowing-out of institutions at the governorate level through the erosion of real-term fiscal transfers and the reliance on ad hoc revenue raising (Jautz, Basalma and Rogers, 2022); Whalley and Al-Awlaqi, 2023); World Bank, 2023a). As noted in Section 3.2, this has had severe consequences for environmental and resource governance. The World Bank has argued accordingly that ‘the first challenge’ to a wider political settlement will be ‘to strike an appropriate balance between the national and subnational governments’ (World Bank, 2023a: 95).

44 Interviews T#09.

a Hadhramaut

In Hadhramaut, these challenges are highly evident. Our interviewees were emphatic that the IRG was largely absent, leaving a state of ‘chaos’ or ‘anarchy’ in the agriculture and water sectors, with no ‘vision or correct ideas for how to manage this.’⁴⁵ One interviewee summarised that there is ‘no help from the centre’ and posed the question: ‘If the authority cannot provide diesel for farmers and fishermen, and cannot provide fuel in general for development purposes, and for water pumps, then where does its legitimacy come from?’⁴⁶ (The formulation of this statement is clearly quite calculated, but that is itself a data point.)

There were several highly visible issues that recurred in these conversations. By far the most frequently mentioned was the lack of credible response to currency depreciation and the associated livelihoods crisis (already discussed in Section 3.2). A linked grievance concerned interruptions and dysfunctions in import/export markets, affecting household survival in a context where 90% of calories are imported, and the viability of rural livelihoods. A 2023 IRG ban on fish exports was viewed as a disconnected policy that had reduced prices and incomes. Incidents in 2024–2025 where Saudi Arabia refused imports of onions and fish were also mentioned as critical failures, and viewed as driven by political dynamics rather than by sanitary or phytosanitary issues. The point was that while both of these sub-sectors amount to a rounding error for Saudi imports overall, they have direct and profound significance in the Hadhramaut economy and household food security.

We heard a similar narrative of state withdrawal or absence in the demarcation and enforcement of fishing zones between Hadhramaut, al-Mahra, Socotra and Somalia. An interviewee from the fishing sector highlighted the specific environmental protection laws applied in other governorates, such as Al-Mukalla and Al-Mahrah, that needed local replication.

All of these dynamics have particular significance in Hadhramaut, given its political history and present-day political landscape (discussed in Section 3.1). The governorate is effectively divided into competing zones of control, neither of them especially well aligned with the IRG. Historically, Handramawt has been the site of both separatist political movements, along with public mobilisation and protest. The latter have become increasingly frequent over the past few years and have specifically concerned economic conditions and basic services, as noted in Section 3.1. It may be assumed that this dynamic will be, or is already, mobilised by the STC and HTA to support their regional ambitions.

b Taizz

In Taizz, the same broad observations hold. There is a widely held perception that the IRG has focused on conflict with Houthis rather than its responsibilities, and we heard recurring feedback that key ministries (Water and Environment, Agriculture and Irrigation) are ‘only seen in the media.’⁴⁷ An interviewee noted that this caused ‘widespread resentment due to the government’s failure to provide basic services’⁴⁸ The most commonly mentioned criticisms included currency depreciation and food affordability, household access to water, sanitation and pollution, fuel, and control/diversion of humanitarian aid by local elites.⁴⁹

45 Interviews H#01, H#02, H#03, H#20.

46 Interview H#01.

47 Interviews T#01 T#02 T#03 T#07 T#11 T#16.

48 Interview T#04.

49 Interviews T#03 T#05 T#11 T#12 T#16.

As in Hadhramaut, this has caused an increasing tempo of protests, demonstrations and social media criticism centred on grievances related to service provision.⁵⁰ Protests over the past few years have called specifically for the fall of the government, and it has been reported that ‘the STC has accused the government of waging a “war of services” in its areas’ (International Crisis Group, 2022: 33). While neither trend should be taken entirely at face value, the criticisms must also be viewed in a historical context where longstanding ‘vertical’ (state-society) grievances have combined with factional politics and become full-scale national political crises (1994, 2011, 2014).

c Links to macro scenarios

Overall, these trends may be expected to contribute materially to Yemen’s broader political trajectory. The nation’s post-unification history indicates that the governance of social-environmental systems – food security, water, cost of living, energy – is at the centre of public perceptions and experiences of government. In this sense, there are ‘ready-formed’ grievance narratives about the IRG, which are being reinforced by extreme levels of hardship in daily life (see Section 3.2).

A key question is who is likely to participate in such social unrest. Evidence from the Arab Spring suggests that political engagement, rather than unemployment or immediate material hardship, is a strong predictor of participation (Paasonen, 2020). In this regard, the most vulnerable social groups are becoming less politically passive.

Women play an increasingly visible role in politics, as noted in Section 3.1. The Houthis have established dedicated structures and tools to engage and mobilise them, including the Zainabiyat female battalion. Its members carry out surveillance, infiltrate women’s discussion groups, and mobilise contributions to the war effort (Mohammed, 2025). These groups also act as vectors of ideological and territorial control, transmitting narratives and practices within households and communities, underscoring that women’s participation is not incidental but strategically important.

Yemeni youth have become increasingly visible in civic and online arenas. Young leaders and influencers are carving out spaces for voice and mobilisation.⁵¹ Their activism is politicised and closely monitored, forcing them to adapt. As Taizz human rights activist Hossam Ahmed explained, every time he visits his family in Sana’a, he has to change his phone and delete his social media accounts.⁵² Despite such risks, social media nonetheless remains a key channel for the mobilisation of popular protest in both Taizz and Hadhramaut. Beyond politics, cultural and creative initiatives⁵³ are also providing avenues for youth to assert leadership and shape narratives around empowerment and peace.

50 Interviews T#04 T#07 T#12 T#18.

51 In Taiz, Maheen al-Abidi is a prominent advocate and activist for human and community rights. She is a member of the women’s advisory team to the UN Special Envoy to Yemen (TAG) and founded the Mu’ayin Centre for Community Development, which provides legal assistance to incarcerated women and monitors human rights violations. Her work has been recognised internationally, notably in the BBC’s 2022 list of the 100 most influential and inspiring women in the world. Similarly, Hadeel al-Sharmani, a journalism student in Taiz, aspires to become the voice of blind people, using the media for social advocacy and trying to raise awareness of their rights. In Hadhramaut, young journalist and social media activist Hala Fouad Badawi also shows that activism in these governorates can be dangerous. She was arrested and imprisoned in 2021 for criticising corruption and demanding better living conditions.

52 See <https://smex.org/social-media-censorship-threatens-journalists-and-bloggers-in-yemen/>

53 Initiatives such as UNESCO’s Humans of Taizz encourage these individuals to tell their stories, as does the Yemen Creative Hubs project, supported by the European Union and present in Taizz and Hadhramaut. It strengthens the capacity of more than 9,000 young creators, enabling them to produce cultural content and engage in discussions on youth empowerment and peacebuilding.

For women and youth, the livelihood opportunities and social positions they have gained during the conflict are fragile. If stability returns and men resume previous economic roles, these groups risk losing both material and social gains. Such losses are not merely economic. Actors who have become politically conscious and publicly engaged may experience frustration or deepened grievances, which in some cases can translate into active resistance. The growing politicisation of these groups, and their awareness of the power dynamics shaping access to opportunity, will thus profoundly influence both present and future conflict risks.

A final important note is that while the feedback summarised above was very consistent, it does not imply that the IRG has wholly vacated the field. Some observers find that ‘the overwhelming impression is that local authorities and institutions are doing what they can, given the constraints under which they operate’ (Lackner, 2021: 22). Our interviewees also identified a few areas of tangible progress; for example, in Taizz ‘electricity came to the coast with support from the United Arab Emirates, and government authorities took over providing it in a not bad way’.⁵⁴ However, in interviews where these positive impressions were shared, they co-existed with strong and direct criticism of central ministries.

4.2 Effect on HMG high-level objectives

Each of the environment–conflict pathways discussed above is significant at the intra-communal and inter-communal levels. In this sub-section, we consider how they interact with overall HMG objectives for engagement in Yemen, i.e., advancing peace through support for the OSESGY-coordinated process; alleviating the humanitarian crisis; increasing economic stability; promoting security; and empowering women and girls.

Table 4 summarises the ‘meso-to-macro’ links between environment–conflict pathways and the scenarios described in Section 2.2, namely (i) stalemate and decline; (ii) escalation and externalisation; and (iii) the double marginalisation of vulnerable groups. We discuss the final ‘islands of progress’ scenario immediately below the table.

These links are best understood as reinforcing feedback into national-scale conflict dynamics. The clearest relationship between conflict and environment is evident in the strong feedback loop between the status quo scenario of security stalemate and environmental decline. After a decade of national conflict, regional elites and armed groups have entrenched economic interests in the water and agri-food sectors. This situation affords them a high level of functional autonomy, contributing to inertia in the Track 1 peace process, and creates obvious obstacles to the reform of these sectors. At the same time, extreme public hardship critically undermines the legitimacy of the IRG and is instrumentalised to strengthen political support for its local rivals (not always successfully).

Alongside this there are potential pathways – plausible but not probable – that connect environmental risks to a scenario of escalation and externalisation. These include the latent potential for IRG-aligned factions to split apart where their interests on the ground are threatened; the unpredictable consequences of ‘weaponising’ the water and agri-food sectors; and the metastatisation of an increasingly volatile public mood into a critical mass of the kind seen in 1994, 2011 and 2014.

⁵⁴ Interview T#20.

The third column in Table 4 emphasises the background conditions of both the previous scenarios. It must be expected that the dysfunctions of a ‘zero-regulation’ environment for the basic requirements of daily life, most notably water and food security, will be felt most keenly by the most vulnerable.

Table 4: Links between conflict pathways and macro-scenarios

Stalemate and decline	Escalation and externalisation	Double marginalisation
(I) Entrenchment of the conflict economy		
<ul style="list-style-type: none"> Regional factions are operationally autonomous owing to economic interests in water, agri-food and energy sectors. Strong elite and business interests in status quo drive resistance to stronger environmental governance (e.g. water, energy markets). 	<ul style="list-style-type: none"> Serious public unrest, linked to dysfunctions of the conflict economy. These can escalate quickly and unpredictably. Regional factions may break away from IRG and/or the Track 1 process where interests are threatened. 	<ul style="list-style-type: none"> No safety nets for vulnerable groups owing to ‘zero-regulation’ markets for water, food, and energy. Women are particularly exposed to loss of agricultural livelihoods and face significant social risks in finding alternatives.
(II) Securitisation of resource governance		
<ul style="list-style-type: none"> Steady flow of local-level resource conflict from revenge cycles and the involvement of armed groups in resource disputes. Security environment drives continued deterioration/ disinvestment in essential water and agri-food infrastructure. 	<ul style="list-style-type: none"> Reciprocal economic warfare is a recurring feature of national conflict (key ports, the Taizz ‘siege’) and could spark escalation. Regional conflicts over environmental-economic interests are a ‘hard-to-predict’, destabilising factor for Track 1 processes. 	<ul style="list-style-type: none"> Responsibility for household coping strategies exposes women and IDPs to inter-personal violence in illicit economies.
(III) Decline of IRG legitimacy		
<ul style="list-style-type: none"> Hardship undermines public confidence in the Track 1 process and efforts to build capacities of the IRG. Regional factions instrumentalise public grievances to undermine and stall national-level political processes. 	<ul style="list-style-type: none"> Unrest/riots can expand unpredictably after highly visible governance failures, e.g., regarding food markets or flood responses. Hardship contributes to a critical mass of support for separatism, especially in Hadhramaut. 	<ul style="list-style-type: none"> IRG lacks policy tools to support normative agendas for rights of women, IDPs, <i>Muhamasheen</i>. Enrolment of women in auxiliary roles for regional factions/ armed groups.

The importance of the ‘islands of progress’ scenario in supporting communities and vulnerable groups

This is a best reasonable case scenario. It assumes that the IRG performs visibly better on politically salient environmental governance challenges; that import–export markets stabilise; and that the agri-food sector becomes less maladapted, even as insecurity and political fragmentation persist. It is counterfactual in the sense that it assumes the interruption or partial reversal of the dynamics noted in Table 4.

In examining Yemen’s security, environmental, and climatic challenges, it appears highly unlikely that the conditions required for such a scenario will be met at the national level. Yemen remains the world’s largest humanitarian crisis, and even under optimistic assumptions humanitarian outcomes would likely remain at crisis levels, though with somewhat reduced exposure and vulnerability to environmental risks.

Nevertheless, the idea of islands of progress remains useful. It encourages us to look for pockets of improvement – cases where progress is achievable, even if uneven. The key question is therefore not only whether progress is possible, but at *what* scale and *for whom*.

Evidence from the literature and interviews suggests that the most credible signs of progress currently appear locally and among specific social groups, rather than nationally or regionally:

- At the *community level*, some organisations and traditional structures continue to manage resource access and distribution despite severe constraints. What might be seen as islands of progress in this context often build on pre-existing systems of local governance, particularly tribal and customary arrangements that have historically filled the void left by weak state institutions. Their relative success depends less on formal state capacity than on accumulated local knowledge, trust networks, and the ability to mediate access fairly within and among communities. Yet these local systems are increasingly under strain from environmental stressors, competition over groundwater, and the absence of reliable information flows to national or international actors. In some areas, such as parts of Hadhramaut where irrigation cooperatives, water user groups, and early warning systems are still operating, these fragile mechanisms show that adaptive progress remains possible, even amid governance vacuums.
- At the *social-group level*, the most tangible progress is visible among women and youth who have found new ways to lead, organise, or innovate under crisis conditions. These changes are socially important, even if not economically transformative. However, their continuity depends on broader structural shifts; without recognition, resources, or space to consolidate roles, such progress risks reversal if stability returns under old hierarchies.



Photo by Shaker Abdullah

5

Existing climate–environmental programmes

This section assesses how effectively the environmental risks (discussed in Section 3) and environment–conflict pathways (discussed in Section 4) are being addressed by ongoing climate adaptation and mitigation programmes in Yemen. In this review, we consider development interventions supported by bilateral and multilateral actors and where climate objectives are mainstreamed as climate programmes.

While the assessment adopted a systematic methodology (outlined in Section 2.3) to ensure the robustness of findings, it relied only on publicly available information. It is possible that programmes have attempted to gain a deep understanding of the political economy of environmental-related conflicts, and have attempted to address these during implementation, but chose not to disclose these as a means to do no harm.

5.1 Extent to which ongoing programmes address environmental risks driving conflict

The four major environmental risks driving environment–conflict pathways are all key priority areas for adaptation and resilience interventions identified by Yemen’s national climate policies. Table 5 in Annex 1 contains a full mapping of Yemen’s climate adaptation priorities.

Table 5: Yemen’s key environmental risks mapped against national adaptation priorities

Key environmental risks driving conflict	Adaptation and resilience measures prioritised in Yemen’s national climate policies
Overreliance and overexploitation of groundwater	<ul style="list-style-type: none"> • Water storage and rainwater harvesting systems • Improved water distribution systems • Rehabilitation of traditional irrigation channels • Enclosed conduits (to reduce evapotranspiration) • Drip irrigation systems • Desalinisation

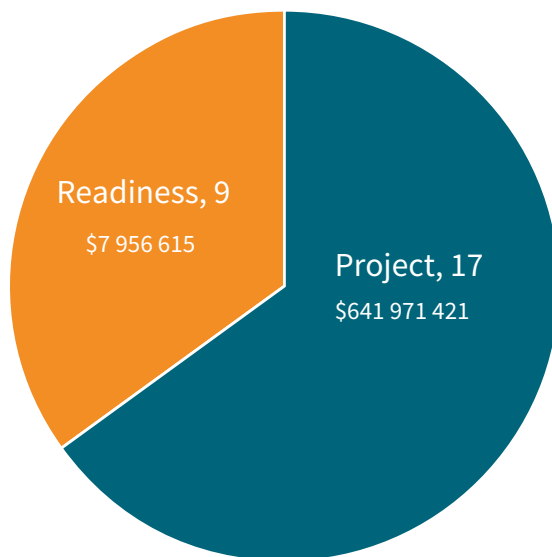
Key environmental risks driving conflict	Adaptation and resilience measures prioritised in Yemen's national climate policies
Pollution and degradation of water, air, agricultural land and wetlands	<ul style="list-style-type: none"> • Ecosystem protection • Integrated coastal zone management • Beach protection and nourishment • Mitigating impact of sea-level rise • Flood management • Wastewater treatment • Planning guidelines for ecotourism • Integration of climate risks into regulatory frameworks (EIA, SIA) • Epidemiological surveillance • Health preparedness systems
Maladaptive agricultural and fishing practices	<ul style="list-style-type: none"> • Climate resilient crops and seed banks • Crop cultivation changes or rotation • Diversified livelihoods (off-farm income) • Soil conservation and fertility improvement • Sustainable fishery management
Unaddressed extreme weather events	<ul style="list-style-type: none"> • Climate information and early warning systems at all levels • Building local capacity to monitor and respond • Flood management • Drought management • Establish disaster management centres

Note: See Annex 1 for a full mapping of Yemen's climate adaptation and resilience priorities.

Source: authors, drawing from key national climate policies. See Annex 1.

Of the 26 climate programmes in our analysis, nine are aimed at so-called 'readiness' activities to build institutional capacity and policy frameworks. These are necessary to address the governance dimensions of key environmental risks driving conflict in Yemen (see Figure 8). These readiness programmes are limited in size, ranging from USD 0.3 to 3 million. They support the creation of strategic climate and biodiversity frameworks and policies; build government institutional capacity and governance systems to design, implement, monitor and report on policies and interventions; and create pipelines of bankable climate and environmental projects ready for international funding.

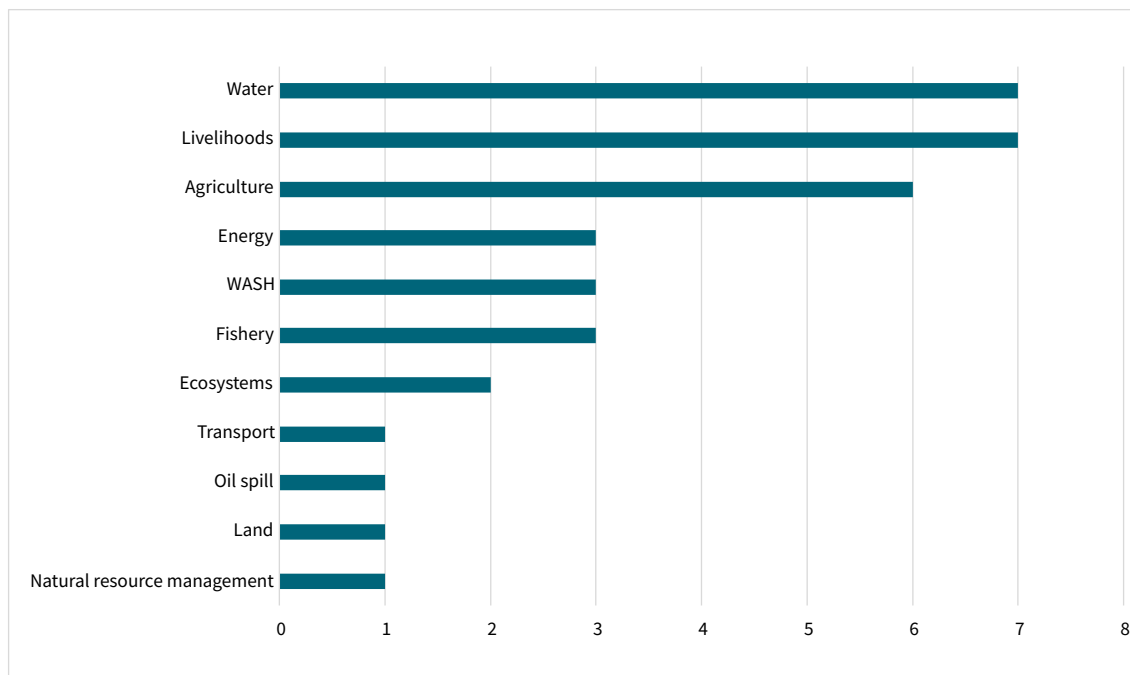
Figure 8: Types of climate project



Source: Authors

The remaining 17 climate projects are large-scale interventions, with budgets of USD 4–100 million, and include resilience investments to directly support communities, cities and rural areas and to build new infrastructure. The objectives of these projects map closely onto the key socio-environmental stresses driving conflict dynamics and the adaptation priorities of Yemen. Figure 9 shows the adaptation areas targeted by these projects and the number of projects in each key area.

Figure 9: Frequency of adaptation areas targeted by climate projects in Yemen



Note: The figure is a tally of adaptation areas targeted by projects; therefore, they cannot be aggregated, given that an individual project may feature adaptation interventions in one or more areas.

Source: Authors

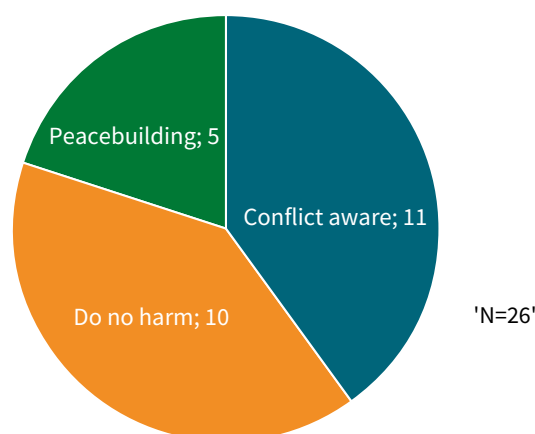
However, the analysis also reveals several adaptation areas that are either overlooked or receiving insufficient attention by existing climate interventions (see Annex 1). If these are left unaddressed, a build-up of socio-environmental stresses in these areas could further exacerbate conflict dynamics or create new ones. They are as follows:

- **Adaptation to increasing heat:** An estimated 7.2 million people in Yemen are already exposed to extreme heat, particularly along the coasts. Under all climate scenarios, extreme hot days (>30°C, >35°C) and hot nights (>20°C) will increase considerably (see Box 1). Especially at night time, when temperatures remain above 20°C, the human body reaches a physiological threshold where it cannot properly cool down to achieve restorative sleep. Building cooling systems in urban environments and strengthening people’s preparedness to extreme temperatures and droughts are fundamental in coastal cities like Aden and Al-Houdeidah.
- **Climate services and early warning systems for droughts, floods, storms and diseases:** Adaptation priorities should be supported by functioning and effective climate information and early warning capacities. Initiatives to strengthen these capacities exist, but have been small and uncoordinated, and often provide inconsistent warnings, sometimes only during extreme weather events and not before (Aklan, 2023). The Yemeni government is aware of the importance of reliable and actionable climate information and is prioritising the early warning project out of the eight it is developing under the Yemen GCF country programme (GCF, 2024).
- **Reducing exposure to sea-level rise and protecting coastal infrastructure:** Support has been limited.

5.2 Conflict-sensitive practices in ongoing programmes

Our conflict sensitivity analysis of active climate projects shows that 11 projects were conflict aware, 10 adopted a ‘do no harm’ approach, and five sought to actively build peace as co-benefits. No project was conflict-blind. (See Figure 10.)

Figure 10: Conflict-sensitive approaches in Yemen’s climate projects



Conflict-aware projects are those that acknowledge in their context analysis the extensive impact that the civil war has had on the country’s human development, economy, infrastructure and the environment, and recognise that it can pose challenges to the success of the project

itself. However, this awareness is unidirectional and they do not explicitly consider how their actions may interact with the conflict. Therefore, they do not feature in-depth conflict sensitivity analyses nor do they put in place interventions or mechanisms to mitigate the potentially negative outcomes of their actions.

Most of the conflict-aware projects in our analysis sample are readiness programmes

(seven of the nine). This may be explained by the fact that these programmes typically focus on building the capacity of national institutions and do not get involved directly with communities and local institutions. Therefore, they tend to have little exposure to the conflict context on the ground. They have typically also been smaller in size (USD 0.5–USD 1 million), with perhaps fewer resources to carry out in-depth conflict analyses and set up mitigating measures. An exception to this is the GCF-funded project to develop Yemen’s National Adaptation Plan (USD 3 million budget) which adopts a maximalist peacebuilding approach (see below).

About 40% of the projects adopt a ‘do no harm’ approach, making explicit provisions in their design, implementation, monitoring and risk management to address the two-way interaction between the project and the conflict context. To avoid or mitigate the risks of worsening conflict dynamics, creating new tensions or causing harm, these projects have taken a number of measures, including the following:

- **Seeking deep and detailed understanding of the conflict context:** All projects at this level are particularly aware of how external interventions may be perceived, and mandate environmental and social impact assessments, with a few requiring better understanding of potential for conflict or violence risks. Four projects explicitly mandated detailed conflict analyses. Many projects (seven of 26) also put particular emphasis on avoiding elite capture (to be managed through transparent contracting or disbursement of resources). Some mentioned the role of NSAGs and other warring parties.
- **Using exclusion lists:** This measure prevents specific interventions or investments that may worsen conflict, such as physical resettlement, economic displacement, land acquisition or land access restriction, activities in disputed areas, and investing in communal grazing and rangelands where rights may be subject to community policing or tribal tensions.
- **Focusing on interventions to mitigate existing drivers of conflict:** For instance, the GEF-funded Resilient and Sustainable Livelihoods for Rural Yemen project specifically aims to substitute *qat* cultivation with more sustainable agriculture crops such as coffee. Other water projects have promoted water user associations for participatory governance with the active participation of women and marginalised groups. Most projects include in their design guidelines and plans to ensure participation, inclusion and ownership by communities, local institutions and national actors.
- **Monitoring:** Almost all projects mention training staff for conflict-sensitive implementation and communication. Several mentioned creating early warning systems to avoid conflict-related impacts, or hiring third parties to carry out such monitoring.

Five projects, or about 20%, use a maximalist peacebuilding approach in the design and implementation of climate activities.

- These projects incorporate peacebuilding as a core feature in principles, specific interventions, monitoring or risk management. For instance, the Building Climate Resilience for vulnerable Groups of Urban and Rural areas of Yemen (BCRVGRUAY) project specifically ‘addresses climate change risks within a peacebuilding approach to counteract societal

tensions and potential violence connected to the physical impacts of climate change' and makes this principle a central focus of monitoring during implementation. The area-based approach of the project also lends itself to a deeper understanding of the complex interactions between climate change, conflict, and environmental degradation in local communities.

- **Other projects build specific interventions for conflict resolution and social cohesion.**

The Supporting Resilient Livelihoods, Food Security and Climate Adaptation in Yemen, Joint Programme (ERRY III) has devised several of these measures and tracks them as key output indicators in its logframe: (i) number of community representatives who have increased their knowledge on social cohesion, conflict mitigation and resolution (disaggregated by women/men) through the support of the intervention, and (ii) number of people engaged in the community dialogues for conflict resolution in the targeted communities (disaggregated by women/men), through the support of the intervention. The Yemen Emergency Social Protection Enhancement and COVID-19 Response Project (ESPECRP) seeks to strengthen national institutions, such as the Social Fund for Development and the Public Works Project, to address basic community needs and preserve social cohesion in a context of weakened central institutions. It also uses a bottom-up participatory approach through Village Cooperative Councils, in which community workers are self-targeted and selected, with wages set below market rates to attract the neediest, prevent elite capture and ensure that interventions respond to genuine community priorities, thereby reducing potential for social conflict.

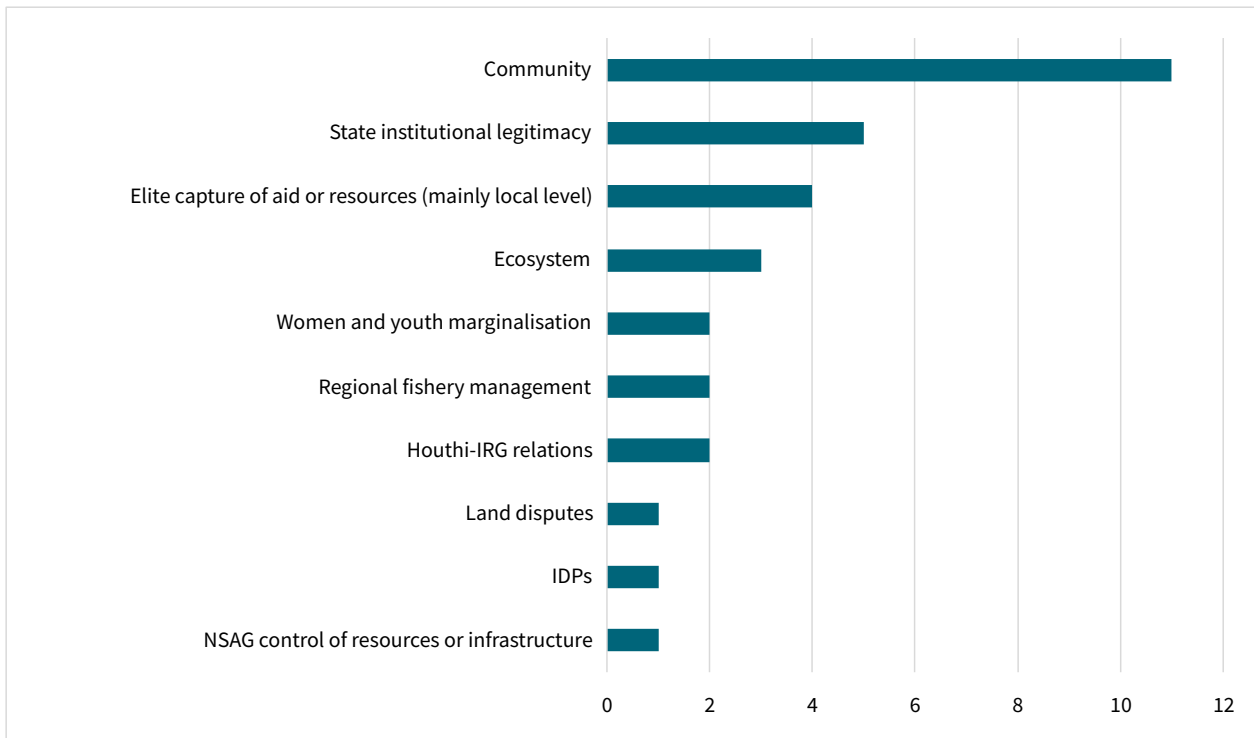
- Projects like the Yemen Food Security Response and Resilience Project (FSSRP), ERRY III and BCRVGRUAY also focus on IDPs as a key vulnerable group, endeavouring to build social cohesion and trust with the host population. The FSSRP explicitly aims to address inter-group relations and foster reconciliation between IDPs and farmers.

Projects have also adopted flexible approaches in implementation and monitoring, allowing early detection of issues and timely redesign of measures, where appropriate, in order to avoid conflict.

5.2.1 Types of conflicts targeted by programmes

Our analysis of the types of conflicts directly addressed by the interventions in our sample of climate projects show that they significantly focus on conflicts at the micro level such as inter- and intra-communal conflict, while placing less emphasis on the other conflict pathways identified in this research (see Figure 11). This may be due to the specific mandates of climate programmes whose primary objective is mitigating or adapting to the impacts of climate change. In these cases, addressing the structural drivers of environmental conflict may fall outside what is currently expected of these interventions.

Figure 11: Types of conflict considered by climate projects in Yemen



Note: The figure is a tally of conflict types addressed by climate projects; therefore, the number of projects cannot be aggregated to an overall total, given that an individual project may target more than one type of conflict.

Source: Authors



Photo by Shaker Abdullah

6

Conclusions and considerations

Key takeaways

This study has argued that the apparent stalemate in Yemen, after a decade of national conflict and with durable “frontlines” in locations like Taizz, is not static. Instead, it is characterised by the steady intensification of environmental risks, which are feeding in turn into the structural drivers of conflict.

The drivers of these environmental risks are analysed in detail in Section 3.3 and summarised below in Table 6.

It bears repeating that three of these social-environmental systems are already beyond crisis point, measured by any relevant normative standard for food security, access to potable water, and water and vector-borne diseases.

Table 6: Summary of key drivers of the environmental risks discussed in Section 3.3

Maladaptive agricultural and fishing practices (Section 3.3.2)	Overreliance and overexploitation of groundwater (Section 3.3.1)
<ul style="list-style-type: none"> • Only 3% of land is arable; erosion and weak governance drive ‘random’ use of wells, inputs, and fishing. • Heavy import dependence and currency depreciation undermine food affordability, leading to food insecurity. • Fisheries: Unregulated, destructive practices deplete stocks; traditional coordination collapsed. • Taizz: Rapid <i>qat</i> expansion drains potable water, displacing food crops. • Hadhramaut: Diesel-based irrigation is four times the national average; high costs are causing land abandonment and desertification. 	<ul style="list-style-type: none"> • Groundwater extraction far exceeds recharge; per-capita water availability has dropped 60% since 1990. • Traditional collective water management systems replaced by unregulated private wells, deepening inequality and depletion. • Climate pressure: Rising temperatures and erratic rainfall accelerate depletion, risking aquifer exhaustion by mid-century. • Taizz: Over-pumping of the Tawilah aquifer; conflict, Houthi control, and rural–urban transfers intensify scarcity and unrest. • Hadhramaut: Reliance on Mukalla aquifer is abstracted ten times faster than recharge; flash floods cause damage without replenishment.

Pollution of water, air and soil (Section 3.3.3)	Unaddressed risks of extreme weather (Section 3.3.4)
<p>Taizz</p> <ul style="list-style-type: none"> • Collapse of sanitation systems and waste collection contaminates groundwater and farmland. • Natural fluoride in volcanic geology + evaporation concentrate toxins in shallow wells. • Conflict-related fuel shortages → open burning of waste → air pollution and health risks. <p>Hadhramaut</p> <ul style="list-style-type: none"> • Oil extraction and poor industrial waste disposal pollute aquifers and soils; floods spread contaminants. • Unsustainable farming and deforestation exacerbate erosion and soil salinisation. • Coastal aquifer overuse and sea-level rise drive salinisation; trawling and oil residues degrade marine ecosystems 	<ul style="list-style-type: none"> • Storms, flash floods, droughts and heatwaves are becoming more frequent and severe, destroying farmland and infrastructure and deepening displacement and livelihood losses. • Poor land management (deforestation, terrace degradation, urban sprawl) and unregulated groundwater extraction magnify drought and flood impacts, preventing natural recharge and accelerating desertification. • Taizz: High rainfall variability and steep terrain trigger recurrent flash floods, damaging terraces, wells, and roads. • Hadhramaut: Sparse rainfall but high exposure to cyclones, flash floods, and sea-level rise endanger settlements and infrastructure, particularly around Al-Mukalla.

This study has also shown that while many internationally supported climate and environmental programmes are targeting the key socio-environmental stressors that drive conflict risks, there are other areas of climate–environmental risks that are overlooked or under-addressed. These include adaptation to increasing heat, which requires urban cooling infrastructure and efforts to prepare communities for extreme temperatures; upgrading flood drainage infrastructure in cities; reducing exposure to sea-level rise and protecting coastal infrastructure; and developing functioning early warning systems.

It must be stressed that climate change, both historical and anticipated, is a factor in all of these trends. However, the more significant drivers relate to (i) policy choices over the past four to five decades, and (ii) the warping effects of protracted conflict upon both governance and markets. We believe that clarity in this regard is not academic but rather essential in the practice of conflict analysis, in order to address the root causes of environment-related conflicts in Yemen.

The central analytical contribution of this report to the wider body of literature on climate security is that it reveals how the drivers of environmental decline intersect directly with the political economy of the conflict in Yemen, and with longstanding grievance narratives in the country. These interactions form a self-reinforcing feedback loop or ‘vicious cycle’. In one direction, conflict and political fragmentation are shaping the most important drivers of environmental pressure. In the opposite direction, intensifying environmental pressures are feeding into three identified conflict pathways. These pathways are discussed in detail in Section 4 and summarised in Table 7.

These pathways show that the interactions between environmental, political and security fragility are not confined to the community level but extend to the subnational and national levels. This finding is critical, as most active climate and environmental programmes have focused on community-level conflict dynamics and have overlooked the conflict and fragility risks at these other scales (often because of their mandate limitations). This is a gap that other stakeholders,

including stabilisation and peacebuilding actors, should address. Neglecting these risks may exacerbate ongoing conflict dynamics.

Table 7: Summary of the environment–conflict pathways discussed in Section 4

Entrenchment of conflict economy (Section 4.1.1)	Securitised governance of NR (Section 4.1.2)
<p>Through the material sustainment of regional factions and armed groups:</p> <ul style="list-style-type: none"> • Direct taxation and indirect business interests for non-state armed groups. <p>Transition risks linked to stakeholder interests:</p> <ul style="list-style-type: none"> • Growing elite/business interests in informal/illicit economies for water, land, and energy. <p>Impact of illicit economy on vulnerable groups:</p> <ul style="list-style-type: none"> • Disproportionate impact of illicit markets on vulnerable groups, including coercion and exclusion. <p>Micro-economic incentives for households:</p> <ul style="list-style-type: none"> • Crisis in rural livelihoods and recourse to illicit economy (in the above sectors) or employment with armed groups. 	<p>Through the crowding out of state and customary governance:</p> <ul style="list-style-type: none"> • Direct intervention by security forces and armed groups in resource disputes; • Tactical restrictions on access to natural resources, including damage to infrastructure; • Displacement and weakening of customary systems for dispute resolution; • Increasing use of private security and the proliferation of small arms and light weapons.
Declining legitimacy of IRG (Section 4.1.3)	
<p>Through self-renewing momentum for regionalist and/or separatist agendas:</p> <ul style="list-style-type: none"> • Escalating public protests relating to livelihoods, essential services, and lack of effective policy responses. • Instrumentalisation of grievances by political factions and armed groups. • Functional irrelevance of Ministries in their areas of responsibility, and/or displacement by non-state actors. • High-profile governance failures, e.g., flood response or market shocks. 	

Lastly, this study has examined the linkages between the environment–conflict pathways and meso-to-macro scenarios of political and conflict trajectories in Yemen (Section 4.2). It has highlighted that the risk of the feedback loop between the security stalemate and environmental decline escalating into a deteriorated scenario is plausible though not probable. Such a worsened scenario would probably be marked by reciprocal economic warfare; further fragmentation of the IRG or Track 1 processes; serious public unrest; renewed momentum for separatism; and an unpredictable geographic spread of environmental and economic conflicts. Under both the status quo and this worsening scenario, the impacts on the most vulnerable will be severe.

Within this context, the study has also identified a best-reasonable-case ‘islands of progress’ scenario, characterised by localised disruptions to or reversals of dynamics that underpin the status quo and worst-case trajectories (see Table 7). Such progress is most likely to occur at

the community and social-group level, where women, youth and IDPs can become drivers of innovation and resilience if supported appropriately, and where local practices of resource management could be documented and strengthened so that they can later inform larger programmes. Efforts to foster these pockets of improvement must navigate resistance from entrenched elites seeking to maintain the status quo and from disillusioned youth and women unwilling to see it persist.

Targeted considerations for HMG

This study has shown how environmental fragility can negatively affect progress on all the high-level objectives of the UK government's engagement in Yemen, namely:

- Advancing peace through support for the Office of the Special Envoy of the Secretary-General for Yemen (OSESGY);
- Alleviating the humanitarian crisis;
- Increasing economic stability;
- Promoting security; and
- Empowering women and girls.

Given this context, we argue that HMG must be intentional about its level of ambition regarding both *conflict risks* and *critical environmental risks* in its policy engagement and programming in Yemen. With this in mind, our key recommendation for programmes is to *reduce the environmental risks driving conflict* (as shown in Table 6) and/or *interrupt environment-conflict transmission pathways* (as shown in Table 7).

The challenge is to understand which programmes/instruments and associated professional 'cadres', are best positioned to address which element, and to what extent they can do so, given differing mandates. In this regard, we have considered in our analysis both instruments/programmes that already operate in Yemen (TAFFY, YSF, AFFY, FSSN) and those where the post is eligible to access the mechanisms but has yet to programme (RAF, PHENOMENAL). The following considerations should be borne in mind:

Recognise the significance of environmental stabilisation and peacebuilding in achieving progress towards each of the high-level outcomes of HMG engagement in Yemen. This recognition should be built into the strategic narrative of programme business cases, the Country Business Plan, fund-level outcomes for the Integrated Security Fund (ISF), and analogous processes. This might include language addressing:

- the deeply interconnected dynamics between the humanitarian crisis in key sectors and intensifying stress in the underlying social-ecological systems;
- the contribution of environment/climate stresses to structural conflict drivers and grievance narratives; and
- the intensifying effects of protracted conflict and political fragmentation upon these critical environment/climate stresses.

Across the HMG Yemen portfolio, consider a light audit of existing and potential programmes in relation to the environment–conflict pathways identified in this study and mainstream mitigation measures accordingly. We do not consider a 'risk-avoidance' approach

to be appropriate, given the context, where programmes sometimes acknowledge potential impacts on environmental and conflict dynamics in risk registers but fail to consider them in the programme Theory of Change. Rather, we argue that environmental stabilisation and peacebuilding programmes (TAFY, YSF) should mainstream both climate *and* peace as their primary or top-level outcomes, while adaptation and resilience (RAF, PHENOMENAL), stabilisation (AFFY) and humanitarian (FSSN) programmes should build mitigation of *either* climate or conflict risks as intentional co-benefits. Figure 12 illustrates this four-way typology of mainstreaming.

Figure 12: Mainstreaming of environmental and conflict risk mitigation into existing and planned programmes in Yemen

		Mitigating conflict risks	
		Primary outcome	Intentional co-benefit
Mitigating environmental risks	Primary outcome	(I) Environmental peacebuilding / governance	(II) Resilience / adaptation-led
	Intentional co-benefit	(III) Stabilisation / peacebuilding-led	(IV) Fragility / conflict-sensitive humanitarian

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Annexures



Annex 1

Active climate projects in Yemen

Approval year	Funder	Project title	Type	Duration	Status	Commitment USD	Theme	Implementing agency
2019	Germany	SFD Water/Wastewater Programme VI	Project			\$20,370,575	WASH	
2020	WB IDA	EMERGENCY SOCIAL PROTECTION ENHANCEMENT AND COVID-19 RESPONSE PROJECT	Project	2020-2026	Ongoing	\$117,529,639	Livelihoods, water, land	UNDP, UNICEF
2021	GCF	Strengthening of the National Designated Authority in Yemen and Enabling Strategic Frameworks for Engagement with the Green Climate Fund.	Readiness	2021-2023	Ongoing	\$499,474	Capacity building, strategic frameworks, pipeline development	FAO
2021	GCF	Strengthen the capacities of sub-national authorities and key actors in the water sector to adapt to climate change in the Tuban Delta	Readiness	2021-2023	Completed	\$693,132	Capacity building, strategic frameworks, pipeline development	UN-Habitat

Approval year	Funder	Project title	Type	Duration	Status	Commitment USD	Theme	Implementing agency
2021	WB IDA	YEMEN Food Security Response and Resilience Project FSSRP	Project	2021-2026	Ongoing	\$126,081,668	Livelihoods, agriculture, water	WFP, FAO, UNDP, ICRC
2021	WB IDA	Emergency Lifeline Connectivity Project (ELCP)	Project	2021-2025	Ongoing	\$20,698,950	Transport	UNOPS
2021	WB IDA	Integrated Urban Services Emergency Project II	Project	2021-2026	Ongoing	\$90,462,720	WASH	UNOPS
2021	WB IDA	Yemen Emergency Human Capital Project	Project	2021-2026	Ongoing	\$38,739,360	WASH	UNOPS, UNICEF, WHO
2022	EU & Sweden	Supporting Resilient Livelihoods, Food Security and Climate Adaptation in Yemen, Joint Programme (ERRY III)	Project	2022-2025	Ongoing	\$30,957,434	Livelihoods, energy	FAO, ILO, UNDP, and WFP
2022	GCF	Supporting Yemen's Low Emissions Development through the preparation of the Nationally Determined Contribution (NDC), while enhancing required capacities and project pipeline in support of reducing emission	Readiness	2022-2024	Ongoing	\$850,894	Capacity building, strategic frameworks, pipeline development	UN-Habitat
2022	GEF	GLOBAL BIODIVERSITY FRAMEWORK EARLY ACTION SUPPORT (GLOBAL 6)	Readiness	2023-2024		\$300,000	Capacity building, strategic frameworks	UNDP

Approval year	Funder	Project title	Type	Duration	Status	Commitment USD	Theme	Implementing agency
2022	GEF	Rural Adaptation in Yemen	Project			\$10,000,000	Livelihoods, agriculture, water	IFAD
2022	GEF	Resilient and sustainable livelihoods for rural Yemen	Project	2022-2026		\$16,057,798	Livelihoods, agriculture, water	FAO
2022	GEF	Promoting sustainable fisheries management in the Red Sea Large Marine Ecosystem (Red Sea Fish)	Project	2022-2026	Ongoing	\$7,000,000	Fishery	
2022	Germany	Strengthening the Resilience of The Water Sector in Yemen	Project	2004-2026	Ongoing	\$4,311,705	Water	
2022	Germany	Improving Food Security to Build Resilience in Yemen	Project	2022-2027	Ongoing	\$12,093,806	Agriculture	
2022	WB IDA	Program on sustainable fishery development in Red Sea and Gulf of Aden (SFISH)	Project	2022-2026	Ongoing	\$45,000,000	Fishery	UNDP & BERSGA
2022	WB IDA	Yemen Emergency Electricity Access Project, Phase II	Project	2022-2026	Ongoing	\$86,951,500	Electricity	UNOPS

Approval year	Funder	Project title	Type	Duration	Status	Commitment USD	Theme	Implementing agency
2023	EU	Integrated Response for Resilience and Food Security in Yemen	Project	2023-2028	Ongoing	\$40,008,650	Livelihoods, agriculture, water, natural resource management	Local organisations and IOs
2023	GEF	Umbrella programme to support development of biodiversity finance plans (New GEF 8 Global Programme on biodiversity finance plans)	Readiness	2023-2026		\$327,000	Capacity building, strategic frameworks	UNDP
2023	GEF	Fourth National Communication / 2nd Biennial Update Reports	Readiness	2023-2024		\$850,000		UNDP
2023	GEF	Support the urgent UN-brokered SAFER Salvage Operation to prevent an environmental, humanitarian and economic oil spill disaster in the southern Red Sea	Project			\$4,016,210	Oil spill	UNDP
2023	The Netherlands	Sustainable Watershed Management and Livelihood Enhancement through Reinforced Governance, Resilience Building and Regenerative Agriculture in Wadi Hajr, Hadhramout	Project			\$3,794,121	Water	FAO

Approval year	Funder	Project title	Type	Duration	Status	Commitment USD	Theme	Implementing agency
2024	GCF	Supporting Yemen to develop its Long-Term Low Emission Development Strategy (LT-LEDS) and Measuring, Reporting And Verifying (MRV) system for climate finance and support received	Readiness	2024-2026	Ongoing	\$945,615	Strategic frameworks	UNDP
2024	GEF	Umbrella Programme to Support NBSAP Update and the 7th National Reports	Readiness	2024-2027	Ongoing	\$490,500	Capacity building, strategic frameworks	UNDP
2024	GEF	Integrated conservation and sustainable development in Socotra archipelago and Aden Wetlands, Yemen	Project		Under approval	\$4,416,211	Ecosystems	UNEP
2024	GEF	Building climate resilience for vulnerable groups of urban and rural areas of Yemen	Project		Under approval	\$22,000,000	Livelihoods, agriculture, water, energy	UNDP
2025	AF	Increase the climate change resilience to water scarcity and flooding in the Tuban Delta	Project	2025-2028	Ongoing	\$9,998,560	Water	UN-Habitat

Approval year	Funder	Project title	Type	Duration	Status	Commitment USD	Theme	Implementing agency
2025	GCF	National Adaptation Planning	Readiness	2025-2028	Ongoing	\$3,000,000	Capacity building, strategic frameworks, pipeline development	UNDP
2025	International waters	An Inclusive Approach for Harnessing Marine Ecosystem Services and Transforming to Sustainable Blue Economy in the Red Sea and Gulf of Aden (HESBERSGA)	Project	2022-2026	Ongoing	\$8,267,250	Fishery, ecosystems	UNEP

Conflict sensitivity framework

Conflict sensitivity definitions in this study

Conflict sensitivity in this study is defined as the ‘ability of an organization or programme to understand the conflict context, understand the potential two-way interaction between its own actions and the context, and then act upon this understanding to minimize negative and maximize positive impacts on conflict and peace’ (START Network, 2018; Tänzler et al., 2018). Adopting a conflict-sensitive approach is essential for making programmes effective and adaptable, which are pre-conditions to building long-term resilience to a variety of shocks and stresses, including from climate change, in fragile or conflict settings.

This report adopted definitions for four increasing levels of conflict sensitivity to analyse ongoing climate programmes in Yemen:

Conflict-blind: These are programmes that do not feature any systematic acknowledgment or analysis of the conflict context, including its drivers, actors, or potential impacts on the project and vice-versa. Nor do they feature conflict mitigating mechanisms in their design, implementation, monitoring and risk management. Conflict-blind programmes inherently carry a high risk of worsening underlying vulnerabilities and conflict drivers, exacerbating existing tensions, creating new ones or causing harm.

Conflict-aware: These are programmes that feature elements of conflict dynamics in the programme context analysis, usually to explain or justify deteriorating socio-economic conditions. At this level, programmes consider the conflict influence as unidirectional, focusing only on the impacts of the conflict on the programme, rather than also considering how its interventions might interact with and potentially affect conflict dynamics. As mitigating measures, conflict-aware programmes focus on mechanisms to protect and safeguard the implementation of the programme from conflict, such as focusing on the security of personnel, selecting target communities or localities unaffected by conflict, or enhancing conflict-aware communication. Following international best practices, these programmes feature gender analyses, action plans and environmental and social safeguard plans that address some conflict drivers, such as the exclusion of marginalised population. However, these are usually limited in scope to the direct beneficiaries of the interventions and often miss wider interlinkages with regional and national dynamics of fragility that drive local to national conflict. As such, they may still inadvertently exacerbate conflict processes.

Do No Harm: Programmes at this level seek to systematically understand the conflict context (including its history, social and demographic composition, political system, economy, and security), often through in-depth conflict analyses. ‘Do no harm’ programmes explicitly make provisions in the design, implementation, monitoring and risk management to address the two-way interaction between planned interventions and the conflict, ensuring that the programme does not exacerbate conflict, create new tensions or cause harm. However, ‘do no harm’ programmes do not explicitly seek to exploit opportunities to address the root causes of conflict and actively contribute to building peace, even though this may be an unintended positive effect. Therefore, on the spectrum of approaches, ‘do no harm’ is usually considered a minimalist approach (or a minimal threshold) for conflict sensitivity.

Peacebuilding: Programmes adopting peacebuilding approaches go significantly beyond simply avoiding harm by explicitly including peace outcomes in their core objectives or creating intentional co-benefits of interventions aimed at addressing the root causes of conflict, such as fostering reconciliation, achieving social cohesion, preventing violence, transforming conflict dynamics, or building peace mechanisms and structures. Such programmes go beyond merely working *in* conflict to working *on* conflict, seeking to maximise positive impacts on conflict and peace. This is usually done by:

- strengthening contextually-appropriate mechanisms that allow individuals and groups to resolve conflicts peacefully;
- addressing underlying drivers of insecurity, including structural and cultural forms of violence;
- empowering marginalised and vulnerable groups and ensure their meaningful participation in decision-making;
- building relationships and trust between diverse and even conflicting groups, leveraging common interests to reduce tensions and prevent future violence.
- ensure inclusive design and implementation processes that reduce inequalities and promote greater community cohesion.

This level requires continuous monitoring and evaluation of both intended and unintended impacts on conflict dynamics, with a commitment to adapt strategies to foster sustainable peace and resilience

Source: Based on START Network (2018); Tänzler et al. (2018)

Yemen's climate adaptation priorities and programmes

	2009	2011	2013	2015	2018	2023	2024	2024	
Adaptation priorities	NAPA	PPCR	NC II	INDC	NC III	TAP	GCF	WB CCDR	Active climate programmes addressing adaptation priority
Agriculture									
Climate resilient crops and seed banks	✓		✓	✓	✓		✓	✓	<ul style="list-style-type: none"> • FSRRP • RSLRY • Rural Adaptation • BCRVGRUAY
Drip irrigation systems	✓				✓	✓	✓	✓	<ul style="list-style-type: none"> • Rural Adaptation • BCRVGRUAY
Crop cultivation changes or rotation				✓	✓		✓		
Diversified livelihoods (off-farm income)		✓			✓		✓	✓	<ul style="list-style-type: none"> • FSRRP • RSLRY • BCRVGRUAY
Soil conservation and fertility improvement		✓			✓	✓	✓	✓	<ul style="list-style-type: none"> • FSRRP • ERRY III • Rural Adaptation • BCRVGRUAY
Climate-resilient livestock							✓		<ul style="list-style-type: none"> • RSLRY
Pasture and rangeland rehabilitation					✓				<ul style="list-style-type: none"> • RSLRY
Livestock management				✓					
Veterinary services							✓		<ul style="list-style-type: none"> • FSRRP

	2009	2011	2013	2015	2018	2023	2024	2024	
Adaptation priorities	NAPA	PPCR	NC II	INDC	NC III	TAP	GCF	WB CCDR	Active climate programmes addressing adaptation priority
Access to credit and capital					✓		✓	✓	
Access to markets					✓			✓	• FSRRP
Extension services					✓		✓		• FSRRP
Improving post-harvest storage								✓	• FSRRP
Water									
Water storage and rainwater harvesting systems	✓	✓	✓	✓		✓	✓	✓	<ul style="list-style-type: none"> • Rural Adaptation • ESPECRP • BCRVGRUAY
Improved water distribution systems			✓				✓		<ul style="list-style-type: none"> • ESPECRP • FSRRP • ERRY III • Rural Adaptation • ESPECRP • BCRVGRUAY • Emergency Human Capital • Wadi Hajr
Rehabilitation of traditional irrigation channels			✓		✓		✓		<ul style="list-style-type: none"> • FSRRP • ERRY III
Enclosed conduits (to reduce evapotranspiration)			✓		✓				
De-salinisation					✓	✓	✓		

	2009	2011	2013	2015	2018	2023	2024	2024	
Adaptation priorities	NAPA	PPCR	NC II	INDC	NC III	TAP	GCF	WB CCDR	Active climate programmes addressing adaptation priority
Wastewater treatment							✓		<ul style="list-style-type: none"> • YIUSEP II • Emergency Human Capital • Wadi Hajr
Coastal zone management									
Integrated coastal zone management		✓	✓	✓	✓		✓	✓	<ul style="list-style-type: none"> • HESBERSGA
Protecting coastal infrastructure	✓						✓		
Mitigating impact of sea-level rise	✓						✓		
Beach protection and nourishment					✓				
Ecosystem protection					✓		✓		<ul style="list-style-type: none"> • RedSeaFish • Socotra and Aden wetlands
Sustainable fishery management							✓	✓	<ul style="list-style-type: none"> • SFISH • RSLRY • RedSeaFish • HESBERSGA
Fisheries post-harvest handling							✓	✓	<ul style="list-style-type: none"> • SFISH
Aquaculture							✓		<ul style="list-style-type: none"> • FSRRP
Disaster risk reduction									
Climate information and early warning systems at all levels	✓	✓			✓		✓	✓	<ul style="list-style-type: none"> • FSRRP • BCRVGRUAY

	2009	2011	2013	2015	2018	2023	2024	2024	
Adaptation priorities	NAPA	PPCR	NC II	INDC	NC III	TAP	GCF	WB CCDR	Active climate programmes addressing adaptation priority
Building local capacity to monitor and respond	✓	✓					✓		<ul style="list-style-type: none"> • FSRRP • Rural Adaptation • BCRVGRUAY
Flood management		✓		✓					<ul style="list-style-type: none"> • YIUSEP II • Wadi Hajr
Drought management				✓					
Establish disaster management centres							✓		
Health									
Epidemiological surveillance					✓		✓		<ul style="list-style-type: none"> • Emergency Human Capital
Preparedness systems					✓		✓	✓	<ul style="list-style-type: none"> • Emergency Human Capital
Access to vulnerable populations					✓		✓	✓	<ul style="list-style-type: none"> • ESPECRP • Emergency Human Capital
Enhance services (vaccination, drug supply)					✓				<ul style="list-style-type: none"> • Emergency Human Capital
Strengthen policy framework					✓				
Strengthen health infrastructure					✓				<ul style="list-style-type: none"> • HEAL • YEEAP II • YIUSEP II • Emergency Human Capital
Cities									
Urban flood drainage					✓				

	2009	2011	2013	2015	2018	2023	2024	2024	
Adaptation priorities	NAPA	PPCR	NC II	INDC	NC III	TAP	GCF	WB CCDR	Active climate programmes addressing adaptation priority
Cooling system for extreme heat					✓				
Ecotourism / biodiversity									
Planning guidelines for ecotourism					✓				
Integration of climate risks into regulatory frameworks (EIA, SIA)					✓				
Protection of ecosystems				✓	✓		✓		<ul style="list-style-type: none"> • BCRVGRUAY • Socotra and Aden wetlands
Forest restoration					✓				<ul style="list-style-type: none"> • BCRVGRUAY
Building private sector awareness and incentives for ecotourism					✓				
Area-based approaches								✓	<ul style="list-style-type: none"> • RSLRY • Socotra and Aden wetlands • YIUSEP II • HESBERSGA • NAP • NDC

Climate policies

- **NAPA (2009)** National Adaptation Programme of Action
- **PPCR (2011)** Pilot Program for Climate Resilience
- **NC II (2013)** Second National Communication (to the UNFCCC)
- **INDC (2015)** Intended Nationally Determined Contribution
- **NC III (2018)** Third National Communication (to the UNFCCC)
- **TAP (2023)** Technology Action Plan
- **GCF (2024)** Green Climate Fund Country Programme
- **WB CCDR (2024)** World Bank Country Climate and Development Report

Project acronyms

- **HESBERSGA:** An Inclusive Approach for Harnessing Marine Ecosystem Services and Transforming to Sustainable Blue Economy in the Red Sea and Gulf of Aden
- **BCRVGRUAY:** Building Climate Resilience for Vulnerable Groups of Urban and Rural Areas of Yemen
- **ESPECRP:** Emergency Social Protection Enhancement and COVID-19 Response Project
- **FSRRP:** Food Security Response and Resilience Project
- **Socotra and Aden Wetlands:** Integrated Conservation and Sustainable Development in Socotra Archipelago and Aden Wetlands, Yemen
- **IWRM ERA:** Integrated Water Resources Management to Enhance the Resilience of Agriculture and Food Security Project
- **RedSeaFish:** Promoting Sustainable Fisheries Management in the Red Sea Large Marine Ecosystem
- **HEAL:** Renewable Energy Improve Access to Health Services and Livelihood Opportunities Project I
- **RSLRY:** Resilient and Sustainable Livelihoods for Rural Yemen
- **Rural Adaptation:** Rural Adaptation in Yemen
- **ERRY III:** Supporting Resilient Livelihoods, Food Security, and Climate Adaptation in Yemen (Joint Programme)
- **SFISH:** Sustainable Fishery Development in the Red Sea and Gulf of Aden Project
- **Wadi Hajr:** Sustainable Watershed Management and Livelihood Enhancement through Reinforced Governance, Resilience Building and Regenerative Agriculture in Wadi Hajr, Hadhramout
- **YEEAP II:** Yemen Emergency Electricity Access Project – Phase II
- **YIUSEP II:** Yemen Integrated Urban Services Emergency Project II
- **YEHCP:** Yemen Emergency Human Capital Project
- **ESPECRP:** Yemen Emergency Social Protection Enhancement and COVID-19 Response Project – Additional Finance
- **SIERY:** Yemen’s Strengthening Institutional and Economic Resilience in Yemen



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