# Triple HDP Nexus Approach
# &
# Climate Change Impacts in Yemen

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NEXUS YEMEN INITIATIVE

منظمة عبس التنموية للمرأة والطفل
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# Executive Summary

Yemen stands at the crossroads of **climate change**, **humanitarian crises**, **development challenges**, and **peacebuilding efforts**, making it one of the most complex and pressing emergencies in the world. The country faces prolonged conflict, economic collapse, food insecurity, and environmental degradation, affecting over **21.6 million** people in need of urgent assistance. Rising temperatures, increasing droughts, water scarcity, and extreme weather events are further intensifying resource-driven conflicts, displacement, and instability. Addressing these interconnected crises requires a coordinated, integrated strategy that combines **humanitarian** assistance, **development**, and **peacebuilding**—commonly known as the **Humanitarian-Development-Peace (HDP) Nexus approach**.

The **Yemen Nexus Initiative (YNI)** is a transformative response that seeks to bridge the gap between immediate relief efforts and long-term resilience-building strategies. By implementing the **HDP Nexus** principles, **YNI** promotes food security, economic recovery, climate adaptation, and social cohesion, with a particular focus on key **governorates** such as **Taiz** and **Aden**. The initiative funds and supports programs that restore livelihoods, strengthen governance structures, and enhance community-driven adaptation strategies. Special attention is given to climate-smart agriculture, water resource management, and disaster risk reduction, recognizing **climate change** as a key driver of displacement and conflict.

## Challenges and Barriers

Despite its innovative and integrated approach, **YNI** faces significant structural, financial, and operational challenges:

- **Fragmented Governance and Coordination**: Weak coordination between **humanitarian**, **development**, and **peacebuilding** sectors leads to disjointed efforts and inefficiencies.
- **Financial Constraints**: Short-term funding cycles and a lack of sustainable financing hinder long-term resilience-building programs.

- **Limited Institutional Capacity**: Many local institutions lack the necessary resources and expertise to effectively implement climate adaptation and **development** projects.
- **Inadequate Monitoring and Data Collection**: There is a major gap in tracking and evaluating the long-term impact of climate resilience and **peacebuilding** initiatives.

## Pathways to Sustainable Impact

For the **Nexus approach** to be truly effective, organizations, policymakers, and international partners must adopt stronger coordination mechanisms, innovative funding models, and community-driven solutions. **Key recommendations include**:

1. **Enhancing Cross-Sector Collaboration**: Establishing joint coordination platforms and improved data-sharing systems to maximize impact and efficiency.
2. **Securing Sustainable Financing**: Shifting from short-term emergency relief to multi-year resilience-building investments, including **public-private partnerships** (**PPPs**) for climate adaptation.
3. **Strengthening Local Capacity**: Supporting community-led climate adaptation programs, training initiatives, and local governance strengthening to promote long-term sustainability.
4. **Improving Climate Data Monitoring**: Utilizing **GIS**, **remote sensing**, and standardized impact assessment frameworks to track progress, measure impact, and ensure accountability in resilience-building efforts.

**Yemen's** climate crisis is not just an environmental issue—it is a **humanitarian**, **economic**, and **security challenge** that demands immediate and long-term action. The **Yemen Nexus Initiative** represents a critical step toward resilience, recovery, and **peacebuilding** by integrating climate adaptation, **humanitarian** aid, and **development** efforts. With stronger partnerships, increased investment, and community-driven solutions, **Yemen** can overcome its challenges and build a future where resilience and sustainability go hand in hand.

# Preface

This paper is divided into three sections, each addressing an important component of **climate change** and the **Nexus** strategy in **Yemen**. It intends to give a complete overview of the country's environmental concerns while also investigating potential responses that combine water, energy, and food security.

**Part One:** establishes the groundwork for the study by explaining the **Nexus** idea and its application to **Yemen's** distinct socio-environmental landscape. This section focuses on the theoretical framework and background required to understand how interconnected systems work in addressing resource management concerns.

**Part two:** examines the effects of **climate change** in six **governorates**: **Hadramout**, **Marib**, **Aden**, **Al-Hodeidah**, **Hajjah**, and **Taiz**. It investigates how **climate change** influences water availability, food production, and energy access in these areas. This section also looks at **Nexus**-based actions that can help to reduce climate risks and increase resilience.

**Part three:** offers' findings from an online questionnaire study of **Yemeni** local groups. This section examines major findings from stakeholders involved in climate adaptation and resource management, providing a localized perspective on the viability and efficacy of **Nexus**-based approaches. This section finishes with major suggestions that outline concrete solutions for improving **climate resilience** and sustainable resource management in **Yemen**.

The present study aims to add to **Yemen's** continuing discourse on **climate resilience** and sustainable development. By combining empirical findings with stakeholder viewpoints, we would like to advise policies and initiatives that solve the country's pressing environmental and **humanitarian** concerns.

We extend our gratitude to all contributors that participate the online questionnaire. Their valuable insights and cooperation have been instrumental in shaping this study.

# PART I

# Nexus Definition & Methodology

# Framing the Nexus: Definition, Objectives, and Methodology

## I. Introduction

The **Yemen Nexus Initiative (YNI)** is a comprehensive attempt to improve the integration of humanitarian, development, and peacebuilding initiatives in **Yemen**, addressing the country's multifaceted difficulties. By implementing the **Humanitarian-Development-Peace (HDP) Nexus** principles, **YNI** supports coordinated responses that link short-term humanitarian assistance with long-term development and peacebuilding tactics. For example, the project funds programs that address food security, restore livelihoods, and promote community interaction in governorates such as **Taiz** and **Aden**. **YNI** prioritizes stakeholder engagement, bringing together local governments, international organizations, and civil society to develop and execute context-specific solutions. Despite these advances, the program faces problems such as fragmented governance, financial deficits, and ongoing insecurity, which frequently impede seamless integration. Nonetheless, **YNI** is an important step toward increasing resilience and sustainability in **Yemen's** recovery efforts[1].

The complex and protracted crises in **Yemen** have created an unprecedented need for integrated solutions that address the interplay of humanitarian, development, and peacebuilding challenges. **Yemen** faces one of the world's worst humanitarian crises, with over **21.6 million people** in need of assistance due to ongoing conflict, economic collapse, and climate-related shocks[2]. This crisis is compounded by institutional fragility, resource scarcity, and social fragmentation, leaving the country in a state of acute vulnerability. Addressing these challenges requires moving beyond siloed interventions to adopt a more coordinated and holistic approach.

[1] UNDP, 2023; OCHA, 2023; World Bank, 2022

[2] United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA). (2023). Yemen Humanitarian Needs Overview. Retrieved from https://www.unocha.org/

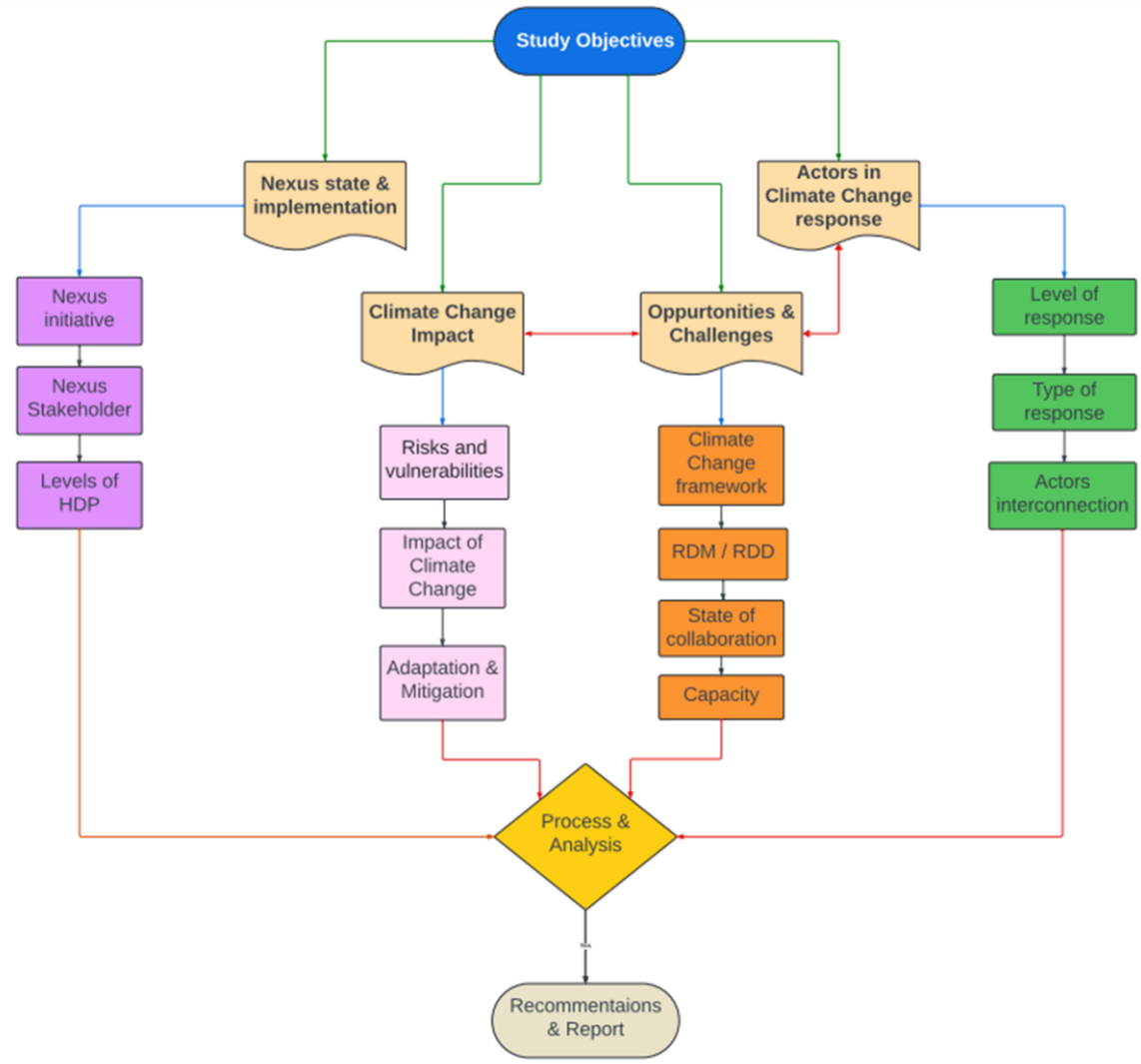


**Fig. 1**: a flowchart depicts the objectives of the study.

# II. Study Objectives

The fundamental purpose of the present study can be summarized as shown in **Fig. 1**. The current study focuses primarily on **Nexus** implementation in **Yemen** and the influence of climate change on the **Nexus** methodology. The following paragraph explains these objectives in four points as follows:

1. **Review Existing Nexus Initiatives and Projects**: Examine ongoing programs and their alignment with the **HDP Nexus** principles.

2. **Identify Key Stakeholders Involved in Nexus-Related Work**: Map out the main actors—national, international, and local—contributing to humanitarian, development, and peacebuilding efforts.

3. **Analyze the Level of Integration Between Humanitarian, Development, and Peacebuilding Actors**: Assess the extent to which **Nexus** principles are operationalized in practice, identifying gaps and opportunities for improvement.

4. **Examine Climate Change Impact**:

   Identify climate-related risks and vulnerabilities in **Yemen**. Also, evaluate how climate change affects **Nexus** initiatives and explore adaptation/mitigation strategies.

5. **Explore Integration of Climate Change into Nexus Approaches:**
   Analyze policy and institutional frameworks for climate change and disaster risk reduction. Also, Identify gaps and opportunities for coordination and capacity building among actors.

6. **Map Climate Change Actors and Responses:**

   Classify national and local actors and their climate change responses (e.g., mitigation, adaptation, policymaking). Analyze the interconnected roles of these actors in addressing climate change challenges.

The findings will be reviewed and documented in final reports, including recommendations.

# III. Study Methodology

This study employs a mixed-methods approach to investigating the implementation and problems of the **Humanitarian-Development-Peace (HDP) Nexus** in **Yemen**. The methodology combines qualitative and quantitative data collecting and analysis to provide a thorough knowledge of **Nexus** policies and their

implementation in the governorates of **Taiz**, **Aden**, **Marib**, **Al-Hodeidah, Hajjah** and **Hadhramout**.

To provide the theoretical framework and contextual background, the study uses secondary data sources such as reports from international organizations, policy documents, and academic literature. Primary data is gathered through interviews and focus group discussions with important stakeholders such as government representatives, foreign and local **Non-Governmental Organizations** (**NGOs**), and community leaders. This approach captures a wide range of perspectives, allowing gaps, difficulties, and best practices to be identified.

The study also includes a case study analysis of specific **Nexus** projects in **Yemen** to assess their impact and sustainability. By combining information from numerous sources, the technique ensures a thorough and nuanced examination of **Nexus** implementation in **Yemen's** complex and changing environment.

## 1. Literature Review.

The research began with a careful review of the relevant literature, papers, and policy documents. This phase was critical in creating the theoretical underpinning for the **Nexus** approach and its implementation in **Yemen**, which is fragile and influenced by external factors such as climate change. The key activities included the following:

- **Examining Global Nexus Frameworks**: To better understand global best practices, we examined documents such as the **OECD-DAC** Recommendation on the **HDP Nexus** (**2019**) and publications from the **United Nations** and other multilateral organizations.
- **Yemen-Specific Analysis**: Reports and policies relevant to **Yemen**, such as climate vulnerability assessments, humanitarian initiatives, and development plans, were analyzed to contextualize the **Nexus** approach in **Yemen's** unique setting.
- **Identifying Gaps**: The review contributed to the identification of gaps in existing studies, particularly in the integration of climate adaptation within **Yemen's Nexus** framework.

## 2. Data Collection.

Data was collected using a variety of approaches to ensure a thorough understanding of the **Nexus approach's** application and its relationship with climate change in **Yemen**. The main activities included:

**a. Interviews with key stakeholders.**

**b. Document Analysis**

## 3. Data Analysis and Synthesis

The collected data was systematically analyzed and synthesized to identify key trends, challenges, and opportunities in implementing the **Nexus approach** in **Yemen**.

**a. Thematic Analysis**

Data from interviews, documents, and field visits were arranged in subject areas such as:

- Integration of humanitarian, development, and peacebuilding operations.
- Climate adaption strategies for the **Nexus** framework.
- Challenges in coordination, funding, and implementation.

**b. Comparative Analysis**

Findings from **Yemen** were compared with global best practices in **Nexus** implementation to highlight areas of alignment and divergence.

**c. Stakeholder Validation**

Preliminary findings were shared with key stakeholders to validate interpretations and ensure accuracy. Feedback from this process was incorporated into the final analysis.

## 4. Report Writing

The final stage involved compiling the analyzed data and findings into a comprehensive report. This report aims to:

Provide an overview of the **Nexus** approach and its relevance in **Yemen**.

- Highlight the intersection of climate change and fragility within the **Nexus** framework.

- Offer recommendations for enhancing **Nexus** implementation in Yemen, particularly in addressing climate change.

# IV. Study Limitations

This study encounters several limitations and obstructions that may affect its comprehensiveness. One significant constraint is time limitations, which restrict the depth of data collection and analysis. The limited timeframe prevents extensive fieldwork and prolonged engagement with stakeholders, which are essential for a more thorough exploration of **Nexus** implementation in **Yemen**.

Additionally, the inability to interview key individuals, such as senior policymakers, international agency representatives, and local authorities, hinders the study's ability to capture critical insights into decision-making processes and high-level coordination efforts. This gap arises due to logistical challenges, conflicting schedules, and security constraints.

Furthermore, reliance on secondary data and reports due to these constraints may introduce biases or inaccuracies, as some sources lack up-to-date information or specific regional insights. Despite these challenges, the study incorporates diverse data sources and adopts the scientific approach to enhance the reliability and validity of its findings.

# V. What is Nexus

The **Humanitarian-Development-Peace (HDP) Nexus**, also known as the **Nexus**, is an integrated framework that aims to bridge gaps and improve coordination and alignment among three traditionally distinct spheres of action: **humanitarian assistance**, **development efforts**, and **peacebuilding initiatives**. The method seeks to improve coordination and coherence among various actors in order to address the underlying causes of crises, minimize vulnerabilities, and promote long-term stability[3].

[3] OECD (2020). States of Fragility 2020: Building Resilience. Organisation for Economic Co-operation and Development. Retrieved from https://www.oecd.org

# VI. Nexus Strategy vs Nexus Objectives

**Nexus *strategy*** and **Nexus *objectives*** differ in terms of focus and breadth. While ***objectives*** define what the **Nexus** method seeks to achieve, ***strategies*** indicate how these goals are operationalized and implemented. The following is an explanation for those two different terms.

**Nexus strategy** provides the ***roadmap*** for achieving those goals effectively. For instance, in **Yemen**, integrating water and sanitation projects with peacebuilding initiatives is part of a strategy to achieve the objective of reducing community tensions and fostering resilience, while the **objectives** define the ***destination*** or the ***purpose*** of the **Nexus approach**, such as fostering resilience or reducing vulnerabilities[4].

**Nexus *strategy*** includes:

- **Humanitarian** relief entails providing immediate aid to preserve lives and alleviate suffering in crisis-affected communities.
- **Development** refers to the implementation of long-term projects that enhance systems and increase resilience, such as health care, education, and livelihoods.
- **Peacebuilding** involves facilitating conflict resolution, strengthening social cohesiveness, and addressing the core causes of instability in order to promote long-term peace[5].

The key ***objectives*** of the **Nexus approach** are:

1. **Strengthening Resilience and Reducing Vulnerabilities**

   The **Nexus** aims to build the resilience of affected communities by addressing both immediate needs and underlying vulnerabilities. For instance, in conflict-affected areas like **Yemen**, this involves not only providing emergency aid but also creating sustainable livelihoods and strengthening local governance

[4] UNICEF. (2023). Integrated Programming for Water and Sanitation in Fragile Contexts.
[5] UNDP. (2023). Enhanced Rural Resilience in Yemen (ERRY) Program Overview.

structures[6]. Programs such as the **Enhanced Rural Resilience in Yemen (ERRY)** focus on empowering rural communities through livelihood support and social cohesion efforts.

2. **Promoting Long-Term Development While Addressing Humanitarian Needs**

   By integrating development into humanitarian responses, the **Nexus** seeks to break the cycle of dependency on aid. This includes infrastructure rebuilding, education access, and economic development projects alongside emergency relief efforts. For example, **UNICEF** has implemented programs in Yemen that combine immediate health and sanitation services with long-term capacity building for local systems[7].

3. **Fostering Peacebuilding and Social Cohesion**

   The **Nexus** emphasizes addressing the root causes of conflict and fostering dialogue among communities. Peacebuilding initiatives are embedded within humanitarian and development actions, such as dispute resolution programs and community-led development efforts in conflict-prone areas like **Taiz** and **Marib**[8]. By addressing grievances and promoting social inclusion, the **Nexus** seeks to create a foundation for sustainable peace.

4. **Enhancing Coordination Among Stakeholders**

   One of the core objectives of the **Nexus** is to enhance coordination between humanitarian, development, and peacebuilding actors. This involves joint planning, shared assessments, and collaborative program design to ensure coherence and maximize impact. In **Yemen**, the **Nexus** approach has facilitated partnerships between **UN** agencies, **NGOs**, and local authorities to implement integrated programs[9].

[6] UNDP. (2023). Enhanced Rural Resilience in Yemen (ERRY) Program Overview.
[7] UNICEF. (2023). Integrated Programming for Water and Sanitation in Fragile Contexts.
[8] OCHA (2023). Yemen Humanitarian Needs Overview 2023. United Nations Office for the Coordination of Humanitarian Affairs. Retrieved from https://www.unocha.org
[9] FAO. (2023). Building Resilient Livelihoods in Yemen.

5. **Aligning Funding and Policies for Integrated Solutions**

The **Nexus** strives to align funding mechanisms and policies to support comprehensive and multi-sectoral interventions. Flexible and multi-year funding streams are essential to allow for a seamless transition from emergency responses to development and peacebuilding initiatives[10].

# VII. What is Durable in the context of Humanitarians

In the humanitarian context, "**Durable**" refers to long-term, sustainable solutions that address the root causes of vulnerability and displacement, allowing impacted people and communities to reconstruct their lives with stability, security, and dignity. These initiatives aim to go beyond short-term relief by increasing resilience and decreasing reliance on humanitarian aid.

Key aspects of durability in humanitarian contexts include long-term solutions for displacement.

5. **Durable Solutions for Displacement:**

- Address the long-term needs of displaced populations (e.g., refugees, internally displaced persons) through:

- Voluntary Repatriation: Safe and dignified return to their place of origin[11].
- Local integration entails permanent residency and incorporation into the host community[12].
- Resettlement is the relocation to a third country or territory.

[10] World Bank. (2022). Multi-Sector Approaches in Conflict-Affected Areas.

[11] UNHCR (2016). Handbook on Voluntary Repatriation: International Protection. United Nations High Commissioner for Refugees. Retrieved from https://www.unhcr.org

[12] IASC (2020). Framework on Durable Solutions for Internally Displaced Persons. Inter-Agency Standing Committee. Retrieved from https://interagencystandingcommittee.org

6. **Resilience Building:**
   - Strengthening the capacity of individuals, households, and communities to cope with future crises and reduce reliance on external assistance[13].
7. **Sustainability:**
   - Ensuring that interventions (e.g., housing, livelihoods, education, infrastructure) are sustainable and adaptable to changing conditions, including climate impacts[14].
8. **Alignment with Development Goals:**
   - Linking humanitarian efforts with development programs to create long-term impacts that align with broader socio-economic objectives[15].

As an example from reality, while temporary shelters for displaced families address urgent needs, permanent housing with access to clean water, education, and livelihood opportunities fosters self-reliance and long-term stability.

# VIII. Nexus Approach vs Durable Solution in the context of Humanitarians

The **Nexus Approach** and **Durable Solutions** are interconnected but different frameworks for solving complex humanitarian issues. The **Nexus Approach** emphasizes the integration of humanitarian, development, and peacebuilding activities to produce holistic and long-term benefits, especially in fragile and conflict-affected areas. It aims to close the gap between short-term emergency responses and long-term development objectives by promoting resilience and lowering vulnerabilities[16]. **Durable Solutions**, on the other hand, are primarily focused on

[13] World Bank (2020). Yemen: Country Risk Profile. Retrieved from https://www.worldbank.org

[14] IOM (2021). Sustainable Solutions for Displacement Settings. International Organization for Migration. Retrieved from https://www.iom.int

[15] OECD (2020). States of Fragility 2020: Building Resilience. Organisation for Economic Co-operation and Development. Retrieved from https://www.oecd.org

[16] IASC (2020). Framework on Durable Solutions for Internally Displaced Persons. Inter-Agency Standing Committee. Retrieved from https://interagencystandingcommittee.org

meeting the long-term needs of displaced populations, allowing them to rebuild their lives with stability and dignity through voluntary repatriation, local integration, or resettlement[17]. While the **Nexus Approach** incorporates systemic reform and cross-sectoral collaboration, **Durable Solutions** focuses on addressing displacement and ensuring sustainable livelihoods for affected people.

[17] UNHCR (2016). Handbook on Voluntary Repatriation: International Protection. United Nations High Commissioner for Refugees. Retrieved from https://www.unhcr.org

# PART II

# Nexus Approach

# The Humanitarian-Development-Peace Nexus and Climate Resilience: Pathways for Sustainable Recovery in Yemen

## I. Yemen Nexus Initiative (YNI)

### Background

This section focuses on the **Nexus Initiative's** potential in **Yemen**, giving a framework for integrated humanitarian, development, and peacebuilding initiatives while also reviewing the initiative's successes and obstacles.

The **Yemen Nexus Initiative (YNI)** is a comprehensive attempt to improve the integration of humanitarian, development, and peacebuilding initiatives in **Yemen**, addressing the country's multifaceted difficulties. By implementing the **Humanitarian-Development-Peace (HDP) Nexus** principles, **YNI** supports coordinated responses that link short-term humanitarian assistance with long-term development and peacebuilding tactics. For example, the project funds programs that address food security, restore livelihoods, and promote community interaction in governorates such as **Taiz** and **Aden**. **YNI** prioritizes stakeholder engagement, bringing together local governments, international organizations, and civil society to develop and execute context-specific solutions. Despite these advances, the program faces problems such as fragmented governance, financial deficits, and ongoing insecurity, which frequently impede seamless integration. Nonetheless, **YNI** is an important step toward increasing resilience and sustainability in **Yemen's** recovery efforts[1].

[1] UN OCHA, 2023, UNDP. (2022). Enhanced Rural Resilience in Yemen (ERRY) Project Overview, World Bank. (2022). Yemen Climate Impact Report.

## The Nexus Initiative in Yemen: A Holistic Approach to Conflict Recovery

The ongoing conflict in **Yemen**, which began in **2014**, has devastated the country, causing what many describe as the world's worst humanitarian crisis. Millions of people are in urgent need of food, clean water, healthcare, and shelter, while infrastructure has crumbled under the weight of prolonged conflict. In response, the international community has increasingly adopted the **Humanitarian-Development-Peace (HDP) Nexus approach**, which aims to align short-term emergency relief with longer-term development and peacebuilding efforts. In **Yemen**, this framework has become known as the **Nexus Initiative**, and it is helping to shape a more coordinated and sustainable response to the crisis.

## The Crisis in Yemen

**Yemen's** conflict began as a political struggle but has since evolved into a regional proxy war, drawing in outside powers and exacerbating the suffering of its citizens. The **United Nations Office for the Coordination of Humanitarian Affairs (OCHA)** estimates that over **24 million** people in **Yemen**—roughly **80%** of the population—are in need of humanitarian assistance[2]. The war has devastated public infrastructure, including hospitals, schools, and water facilities, leaving many communities without essential services.

Traditional humanitarian interventions have focused on providing immediate relief, but this approach has often been insufficient for long-term recovery. With ongoing conflict and lack of a functioning state, development efforts have been stalled, while peace processes have faced significant challenges. This situation has led to calls for a more integrated strategy that addresses not only the immediate humanitarian needs but also the root causes of conflict and underdevelopment.

[2] UN OCHA, 2023.

# The Nexus Initiative: Bridging Humanitarian, Development, and Peacebuilding Efforts

The **Nexus Initiative** in **Yemen** follows the broader global **HDP Nexus framework**, which was formalized by the **UN** and the **World Bank** in **2016**. The core principle of this framework is that humanitarian aid, development programming, and peacebuilding must be interlinked, addressing short-term needs while simultaneously working towards long-term solutions[3]. In **Yemen**, this approach is particularly important because of the complex and interwoven challenges that the country faces.

## Humanitarian Aid

1. Humanitarian agencies in **Yemen** focus on lifesaving interventions, such as food aid, healthcare, and shelter. However, a **Nexus-based approach** ensures that these interventions do not operate in isolation. For example, rather than simply distributing food, organizations under the **Nexus Initiative** work to rebuild local food systems and support agricultural development, helping communities regain self-sufficiency in the long term.
2. **Development:**

   The development component of the **Nexus Initiative** seeks to address the structural issues that have worsened **Yemen's** crisis, such as poverty, unemployment, and broken infrastructure. In this context, development agencies have been working on rebuilding water networks, rehabilitating schools, and training healthcare workers. Crucially, these efforts are designed to complement humanitarian aid, laying the groundwork for a more resilient society.
3. **Peacebuilding:**

   Peacebuilding under the **Nexus Initiative** focuses on conflict resolution at the community level, as well as on broader national reconciliation efforts. Local peacebuilding initiatives often involve bringing conflicting groups together to resolve disputes over resources, such as water or grazing land, which are

[3] World Bank, 2017

increasingly scarce due to the war and climate change[4]. These local peacebuilding efforts are seen as essential in fostering stability and trust in communities.

## Successes and Challenges of the Nexus Initiative

The **Nexus Initiative** is a promising step towards addressing **Yemen's** overlapping challenges, but it is not without obstacles. One of the key successes has been enhanced coordination among international agencies, which have historically worked in silos. For example, the **UN Development Program (UNDP)** and the **World Food Program (WFP)** have partnered to create job opportunities in areas hit hardest by the conflict, aligning their respective humanitarian and development goals[5].

At the local level, community-based peacebuilding initiatives have shown potential. In **Taiz** and **Hudaydah**, for instance, local mediation efforts have succeeded in reducing conflict over natural resources and fostering trust among local leaders[6]. These initiatives, while small-scale, highlight the potential for peacebuilding when local communities are empowered.

However, the **Nexus Initiative** also faces significant challenges, primarily due to the continuing instability in the country. Large-scale peacebuilding efforts have been hampered by ongoing violence, and development programs are often disrupted by security concerns. Additionally, funding gaps pose a serious threat to the sustainability of **Nexus-based interventions**. According to the **United Nations**, **Yemen** remains severely underfunded despite international pledges, with humanitarian organizations struggling to secure the resources needed for both emergency aid and long-term projects[7].

## The Way Forward

Despite the challenges, the **Nexus Initiative** represents a crucial evolution in how the international community approaches complex crises like **Yemen's**. Its focus on linking humanitarian aid, development, and peacebuilding recognizes that none of

[4] Sana'a Center for Strategic Studies, 2022
[5] UNDP, 2020
[6] Saferworld, 2021
[7] UN OCHA, 2023

these elements alone can solve the country's deep-rooted issues. Going forward, the success of the Nexus Initiative will depend on several factors:

1. **Enhanced Coordination**: Coordination among international and local actors is critical for ensuring that **Nexus** programs are effective. This includes harmonizing goals, sharing data, and integrating local knowledge into the design of interventions.
2. **Sustained Funding**: To maintain momentum, the international community must continue to provide funding that supports both immediate relief and long-term development efforts. Bridging the funding gap will require renewed commitment from donor countries and international institutions.
3. **Inclusive Peacebuilding**: A successful peace process in **Yemen** will need to be inclusive, incorporating local actors, civil society, and marginalized groups. Efforts at the national level must be complemented by local peacebuilding initiatives that address the specific needs and concerns of different communities.
4. **Adapting to Context**: As the situation in **Yemen** evolves, so too must the **Nexus approach**. Flexibility and the ability to adapt to changing conditions—whether related to security, climate change, or new development challenges—will be essential for the Initiative's long-term success.

The **Nexus Initiative** in **Yemen** represents a critical step forward in addressing one of the most complex crises in the modern world. By integrating humanitarian aid, development, and peacebuilding, it offers a more sustainable path to recovery and peace. While significant challenges remain, particularly in terms of funding and security, the successes of local peacebuilding and coordinated interventions show that this approach has the potential to transform **Yemen's** future. For the millions of **Yemenis** in need, the **Nexus Initiative** offers a glimmer of hope in an otherwise bleak landscape.

# II. Literature Review: The Nexus Approach and Climate Change in Yemen

The intersection of the **Humanitarian-Development-Peace (HDP) Nexus** approach and climate change in **Yemen** has garnered increasing attention due to the country's protracted conflict, fragile governance, and vulnerability to environmental stressors. This literature review synthesizes key findings from academic studies, reports, and policy documents to provide an overview of the relevance and implementation of the **Nexus** approach in addressing **Yemen's** climate-related challenges.

## The Humanitarian-Development-Peace Nexus Approach

The **HDP Nexus** approach seeks to bridge the divide between humanitarian aid, development initiatives, and peacebuilding efforts, particularly in fragile contexts like **Yemen**. According to **UN** reports, the **Nexus** approach emphasizes fostering resilience, addressing root causes of crises, and promoting coherence among diverse stakeholders[8]. The **Yemen Nexus Initiative (YNI)**, a key effort in operationalizing the approach, aims to integrate these three pillars to achieve long-term stability and sustainable development.

However, the implementation of the **Nexus** in **Yemen** faces significant challenges. Literature highlights the fragmented coordination among stakeholders and the difficulty of aligning short-term humanitarian needs with longer-term development goals amidst ongoing conflict[9]. Despite these obstacles, the **Nexus** framework has shown potential for promoting localized solutions and community participation in addressing systemic issues, including climate adaptation and resource management.

[8] UNDP. (2022). Yemen Annual Report.
[9] ICRC. (2023). Nexus Analysis in Conflict Settings: Yemen Case Study.

## Climate Change Impacts in Yemen

**Yemen** is among the world's most vulnerable countries to climate change, as evidenced by its high ranking in the **Global Climate Risk Index**[10]. The country faces recurring floods, droughts, and desertification, exacerbating food and water insecurity. Research underscores that these environmental stressors amplify existing vulnerabilities and fuel competition over scarce resources, which, in turn, exacerbates conflict[11].

**Climate change** is particularly impactful on agriculture and water resources, which are vital for rural livelihoods. Studies by **FAO**[12] and **UNEP** highlight the need for integrated water resource management and climate-resilient agricultural practices as key strategies for mitigating these effects. Furthermore, the intersection of climate change and conflict complicates humanitarian interventions, emphasizing the importance of **Nexus**-driven approaches to address these interconnected challenges.

## Intersection of the Nexus Approach and Climate Change in Yemen

The **Nexus** approach provides a strategic framework for addressing the climate-conflict **Nexus** in **Yemen**. Several reports stress the role of climate change as both a driver and multiplier of conflict, particularly in resource-scarce regions like **Taiz** and **Al-Hodeidah**[13]. The literature suggests that integrating climate adaptation into peacebuilding and development programs can reduce tensions over natural resources and promote resilience in affected communities.

Notable initiatives include the **Enhanced Rural Resilience in Yemen (ERRY)** project, which focuses on climate adaptation while fostering community-level peacebuilding and development. By promoting renewable energy solutions and water management systems, the project exemplifies the practical application of **Nexus** principles in climate-stressed environments[14].

[10] Germanwatch, (2023). Global Climate Risk Index Report.
[11] World Bank. (2022). Yemen Climate Impact Report.
[12] FAO. (2022). Yemen Climate-Resilient Agriculture and Water Management Strategies.
[13] UNFCCC. (2023). Yemen Vulnerability Report.
[14] UNDP. (2022). Enhanced Rural Resilience in Yemen (ERRY) Project Overview.

## Gaps and Challenges in the Literature

Although the **Nexus** approach is widely recognized as a promising framework, there are limited case studies and empirical data on its effectiveness in **Yemen**. The ongoing conflict and lack of robust governance impede the comprehensive implementation of **Nexus** strategies. Moreover, there is insufficient integration of climate considerations into peacebuilding initiatives, highlighting a critical gap in policy coherence[15].

## Highlights

The reviewed literature underscores the relevance of the **HDP Nexus** approach in addressing the interconnected challenges of climate change and conflict in **Yemen**. While promising examples of **Nexus**-based interventions exist, significant gaps remain in policy coherence, stakeholder coordination, and empirical evidence. Future research and implementation efforts should focus on localized, community-driven solutions and robust monitoring frameworks to enhance the effectiveness of the **Nexus** approach in **Yemen**.

# III. In the Context of the Yemen Crisis: Humanitarian, Development, and Peacebuilding Needs

## Triple Nexus

The ongoing crisis in **Yemen**, which began in **2015**, has evolved into one of the most complex and devastating humanitarian catastrophes globally, resulting from a confluence of armed conflict, economic collapse, and systemic governance failure. Since the escalation of hostilities in **2015**, the country has endured widespread destruction, displacement, and loss of life, leaving millions dependent on humanitarian aid. This multifaceted crisis has also highlighted the necessity for an integrated response that addresses **Yemen's** immediate humanitarian needs while laying the foundation for sustainable development and lasting peace. According to the **United Nations**, over **23 million** people—approximately **75%** of **Yemen's**

[15] ICRC. (2023). Nexus Analysis in Conflict Settings: Yemen Case Study.

population—require some form of **humanitarian** assistance. Key sectors, including healthcare, education, and water systems, have collapsed or operate at minimal capacity, with many areas relying entirely on humanitarian aid to meet basic needs. In **governorates** such as **Taiz**, **Marib**, **Aden**, and **Al-Hodeidah**, the impacts of conflict are felt acutely, with food insecurity, lack of livelihoods, and ongoing displacement creating further strain on already fragile communities. Simultaneously, the absence of effective governance and persistent violence impede **development** and **peacebuilding** efforts, highlighting the urgent need for coordinated, multi-sectoral approaches.

## Humanitarian Needs

**Yemen** faces a dire **humanitarian** crisis with unprecedented levels of need. The **United Nations Office** for the **Coordination of Humanitarian Affairs**[16] estimates that **21.6 million people**, including **80% of women and children**, require life-saving assistance. Among these, **17 million people** are food insecure, with famine-like conditions reported in specific regions such as **Hajjah** and **Al-Hodeidah**. The conflict has decimated agricultural production, disrupted markets, and caused widespread displacement, severely impacting access to food and livelihoods[17].

In addition to food insecurity, **Yemen** suffers from severe health crises. The destruction of healthcare facilities—many of which have been targeted during the conflict—has left the population vulnerable to diseases such as **cholera**, **malaria**, and **diphtheria**. **Cholera** outbreaks alone have resulted in over **2.5 million** suspected cases since **2017**[18]. Maternal and child healthcare has deteriorated dramatically, with **one woman and six newborns dying every two hours** due to preventable complications[19]. **Yemen's** water infrastructure is another critical area of concern. The ongoing destruction of water supply systems has forced over **16 million people** to rely on unsafe water sources, exacerbating the public health crisis and increasing the prevalence of waterborne diseases[20]. Without sustained

[16] UNOCHA, 2023
[17] World Food Program, 2022
[18] World Health Organization, 2023
[19] UNICEF, 2023
[20] International Organization for Migration, 2022

humanitarian support, these conditions will likely worsen, deepening the suffering of millions.

## Developmental Needs

The prolonged conflict has not only caused immediate suffering but also reversed decades of developmental progress, leaving **Yemen** as one of the least developed countries in the world. The economy has shrunk dramatically, with the **GDP** per capita declining by **over 50% since 2015**, according to the **World Bank** (**2023**). **Yemen's** reliance on imports, coupled with blockades and disrupted trade routes, has driven inflation and rendered basic commodities unaffordable for most households.

The collapse of public infrastructure has created severe challenges in education, employment, and public services. Over **2 million children** are out of school, while **over 2,500 schools** have been damaged, occupied, or used for military purposes[21]. Education, a key driver of long-term development, is at risk of being permanently disrupted for a generation of **Yemeni** youth.

Employment opportunities remain scarce, with more than **80%** of the population living below the poverty line[22]. Many families have turned to negative coping mechanisms, such as child labor and early marriage, further exacerbating **Yemen's** social challenges. Addressing these developmental needs requires sustained investment in rebuilding infrastructure, diversifying the economy, and ensuring access to essential services like healthcare and education.

## Peacebuilding Needs

While **humanitarian** relief and **developmental** strategies are critical, they cannot succeed without addressing the root causes of **Yemen's** crisis through **peacebuilding** efforts. **Yemen's** conflict is deeply rooted in historical grievances over resource allocation, regional inequalities, and weak governance. The war has fragmented the country into various factions, with competing interests among local actors, tribal groups, and regional powers[23].

[21] UNICEF, 2023
[22] UNDP, 2022
[23] International Crisis Group, 2023

International mediation efforts, such as the **Stockholm Agreement (2018)** and the recent ceasefire facilitated by the **United Nations**, have provided temporary respite but failed to achieve a sustainable resolution. A key challenge lies in the lack of trust among the warring parties and the exclusion of marginalized groups, including women and minorities, from formal peace negotiations.

Successful peacebuilding in **Yemen** must prioritize inclusivity by engaging all stakeholders, including grassroots organizations and local leaders, in dialogue and decision-making. Efforts should also address the **socioeconomic grievances** that fuel the conflict, such as disparities in resource distribution and access to services. Reintegrating displaced populations and rebuilding social cohesion will be vital to preventing future conflicts.

## Interconnected Needs

**Yemen's** challenges are not isolated; **humanitarian**, **development**, and **peacebuilding** needs are deeply interconnected. For instance, restoring access to education is not just a **developmental** goal but also a **peacebuilding** tool that reduces the vulnerability of youth to recruitment by armed groups. Similarly, rebuilding water and healthcare infrastructure can enhance trust in institutions while improving living conditions, contributing to both peace and development.

The **Humanitarian-Development-Peace** (**HDP**) **Nexus approach** provides a strategic framework for addressing these interconnected needs. This approach emphasizes a coordinated response that aligns immediate **humanitarian** relief with long-term **developmental** goals and **peacebuilding** strategies, ensuring that interventions are sustainable and conflict-sensitive.

The **Yemen** crisis presents a stark reminder of the devastating impact of prolonged conflict on human lives, development, and social cohesion. Meeting **Yemen's** **humanitarian**, **developmental**, and **peacebuilding** needs requires an integrated, multisectoral response that not only addresses immediate suffering but also builds the foundation for a resilient and peaceful future. By adopting the **HDP Nexus approach**, the international community can work towards a comprehensive solution that empowers **Yemenis** to overcome the crisis and rebuild their nation.

# IV. Overview of the Humanitarian-Development-Peace (HDP) Nexus Approach

The **Humanitarian-Development-Peace (HDP) Nexus approach** is a strategic framework designed to tackle the interconnected and recurring challenges of **crises**, **development**, and **peacebuilding**. In **Yemen**, where prolonged conflict and instability have led to overlapping issues, the **HDP Nexus** offers a pathway to strengthen resilience, close gaps between emergency relief and long-term development, and support sustainable peace. Widely acknowledged as vital for addressing complex crises such as **Yemen's**, this approach seeks to harmonize immediate relief with structural reforms to foster resilience and stability.

## A Unified Strategy for a Complex Crisis

**Yemen's** multifaceted crisis—a combination of acute humanitarian needs, fragile development progress, and persistent conflict—calls for an integrated approach. The **HDP Nexus** in **Yemen** emphasizes harmonizing immediate **humanitarian** assistance with strategies that build livelihoods and strengthen governance systems. This unified strategy bridges the divide between short-term crisis response and long-term **development**, ensuring that **humanitarian** efforts lay the groundwork for recovery and growth.

## Breaking Silos to Promote Synergy

The **HDP Nexus approach** in **Yemen** seeks to break down traditional silos between **humanitarian** actors, **development** practitioners, and **peacebuilders**. By fostering collaboration and shared objectives, the **Nexus** aims to create a coherent strategy that addresses both the symptoms and root causes of **Yemen's** challenges. For example, integrating peacebuilding initiatives into development programs ensures that progress in one domain reinforces gains in others, ultimately contributing to a sustainable resolution of **Yemen's** crisis.

## Addressing Root Causes of Vulnerability

**Yemen's** vulnerability is driven by systemic issues such as poverty, weak governance, and limited infrastructure. The **HDP Nexus approach** prioritizes addressing these root causes through capacity building, institutional strengthening, and investments in sustainable **development**. By focusing on the underlying drivers of fragility, the **Nexus approach** aims to reduce reliance on external assistance and promote self-reliance among affected communities.

## Focus on Long-term Resilience

**Humanitarian** efforts in **Yemen** often face the risk of creating dependency. The **HDP Nexus** shifts the focus towards resilience by integrating livelihood programs, restoring basic services, and creating opportunities for community empowerment alongside life-saving aid. For instance, coupling food aid with agricultural training programs helps communities transition from dependence on external support to self-sufficiency.

## Peace as a Cornerstone of Development

Without peace, **development** in **Yemen** remains fragile. The **Nexus approach** emphasizes the critical role of **peacebuilding**—from fostering dialogue between conflicting parties to supporting local reconciliation initiatives—as a prerequisite for long-term stability and growth. Peace is not just an outcome but a necessary foundation for all **HDP Nexus** interventions, ensuring that **humanitarian** and **development** gains are sustainable.

## Localization as a Nexus Priority

The **HDP Nexus approach** in **Yemen** underscores the importance of involving local communities in decision-making. Empowering local actors ensures that interventions are culturally relevant, sustainable, and aligned with the needs of those most affected by the crisis. Localization not only enhances the effectiveness of interventions but also strengthens community ownership, a critical factor for long-term resilience.

## Leveraging Multi-Sectoral Coordination

The **HDP Nexus** encourages multi-sectoral collaboration in **Yemen** by linking **humanitarian** relief (e.g., food security and health) with **development** efforts (e.g., education and infrastructure) and **peacebuilding** activities (e.g., mediation and social cohesion). This alignment maximizes impact and reduces duplication of efforts. For instance, a coordinated effort to rebuild schools can simultaneously address educational needs, create jobs, and foster social cohesion within communities.

## Integrating Climate Adaptation and Environmental Recovery

**Yemen's** increasing susceptibility to climate-related disasters, such as droughts and floods, highlights the need for climate-sensitive interventions. The **HDP Nexus approach** integrates disaster risk reduction, environmental recovery, and sustainable resource management as critical components of **development** and resilience-building. This integration ensures that climate adaptation measures are woven into broader strategies, reducing the risk of future crises and safeguarding **development** gains.

## Guided by Global Principles but Grounded in Local Realities

While aligned with global **HDP Nexus** principles, the approach in **Yemen** is tailored to the country's unique sociopolitical dynamics, including tribal systems, regional disparities, and the role of international actors in peace processes. This contextualization ensures that the **Nexus approach** is not only theoretically sound but also practically applicable, addressing the specific challenges and opportunities within **Yemen**.

## A Platform for Sustainable Partnerships

The **Nexus** method provides a framework for long-term partnerships in **Yemen**, bringing together **governments**, **donors**, **UN agencies**, **non-governmental organizations (NGOs)**, and **private sector entities** to pool resources and expertise toward common goals. The **HDP Nexus** promotes inclusive and long-term collaborations by combining **humanitarian** relief, **development**, and **peacebuilding**.

This coordinated approach has the potential to help **Yemen** achieve resilience, stability, and long-term peace in the face of ongoing challenges. Its success is dependent on stakeholders' ability to collaborate, implement specialized strategies, and remain committed to meeting the country's complex needs.

# V. Current State of Nexus Implementation in Yemen

The **Humanitarian-Development-Peace (HDP) Nexus** implementation in **Yemen** is still in its early phases, with a mix of promising initiatives and ongoing obstacles. **Yemen's** long-running conflict, exacerbated by **climate change**, economic collapse, and poor governance, has produced an urgent need for integrated methods that address immediate **humanitarian** needs while also promoting long-term **development** and **peacemaking**. However, the **Nexus's** operationalization in **Yemen** has been hampered by a number of circumstances, including fragmented governance, security concerns, and a lack of coordination between international funders and local partners[24].

Several programs have attempted to adopt the **Nexus** technique. For example, the **Enhanced Rural Resilience** in **Yemen** (**ERRY**) program, led by the **UNDP** in conjunction with the **FAO**, **ILO**, and **WFP**, aims to improve livelihoods, reduce vulnerability, and promote social cohesion in rural communities[25]. Similarly, **UNICEF** has combined **humanitarian** and **development** efforts through initiatives such as water and sanitation projects, which seek to give both immediate relief and long-term sustainability[26]. Despite these efforts, gaps remain in the alignment of **humanitarian**, **development**, and **peacebuilding** actions, with many initiatives functioning in silos. Furthermore, funding allocations are disproportionately channeled toward emergency relief, often undermining **development** and **peacebuilding** activities that are crucial for long-term rehabilitation[27].

[24] UNDP, 2023; OCHA, 2023
[25] UNDP, 2023
[26] UNICEF, 2023
[27] OCHA, 2023

## Who is responsible for implementing the Nexus in Yemen?

**Nexus-related** activity in **Yemen** involves a number of national and international stakeholders, including:

1. **United Nations Agencies:**
   - **UNDP** focuses on resilience building, livelihoods, and governance. **WFP** and **FAO** should implement integrated food security and agriculture projects.
   - **UNICEF** combines humanitarian assistance with development in the health, education, and water sectors.
2. **International Donors and Organizations:**
   - The **World Bank** supports development programs such as the **Yemen** Integrated **Urban Services Emergency Project**, which connects infrastructure restoration to community stability.
3. **European Union:**
   - **Encourages** programs that combine humanitarian and development efforts. **USAID** and **DFID** encourage multi-sectoral approaches to humanitarian and developmental needs.
4. **Local Government and Civil Society Organizations (CSOs):**
   - Local governance entities, such as **governorate** councils and tribal administrations, frequently play critical roles in enabling **Nexus** projects at the grassroots level.
     **CSOs** such as the **Yemen Women's Union** and **Mwatana** for **Human Rights** carry on community-based **Nexus activities**.
5. **Non-governmental Organizations (NGOs):**
   - International **non-governmental organizations** (**NGOs**) such as **Oxfam**, **Save the Children**, and **CARE** International work on integrated programs that link humanitarian help with sustainable development.

### Challenges in Implementation:

- **Security Concerns**: Persistent conflict restricts access to certain zones, making **Nexus** techniques harder to execute successfully.
- **Coordination gaps:** Weak alignment among humanitarian, development, and peacebuilding actors results in duplication of efforts and squandered opportunities.
- **financing Imbalances:** The majority of financing is directed toward short-term humanitarian relief, leaving little for development and peacebuilding.
- **Fragmented Government:** Divisions between de facto authority and internationally recognized **governments** impede effective implementation.

While **Nexus** implementation in **Yemen** has shown potential through targeted programming and stakeholder participation, significant problems remain. To ensure sustainability and impact, these efforts must be scaled up through improved coordination, equal funding across **Nexus** pillars, and active involvement with local actors.

## VI. Key Actors in Climate Change

Undercurrents investigates the complex relationship between war, rising climate-related risks, and environmental degradation in **Yemen**, all of which endanger security and fuel future conflict, particularly at the grassroots level. The review, carried out in collaboration with the **European Institute of Peace**, explains why climatic and environmental action must be included into **Yemen's** conflict mitigation and peacebuilding processes at all levels.

**Yemen**, a country grappling with significant environmental and **humanitarian** challenges, is particularly vulnerable to the impacts of **climate change**. The escalating issues of water scarcity, extreme weather events, and food insecurity make **climate change** responses crucial. Addressing these challenges involves a collaborative effort by a diverse range of actors, including national **government** bodies, international organizations, local **NGOs**, and community-based stakeholders. The primary actors

engaging in **climate change** responses in **Yemen** at the national and local levels are classified as follows:

## National Governmental Actors:

- **Environmental Protection Authority (EPA):** The **Environmental Protection Authority** serves as **Yemen's** primary governmental organization for regulating environmental laws and implementing climate action initiatives. The **EPA** oversees the development of national adaptation and mitigation plans, attempting to match **Yemen's** environmental policies with global sustainability goals. The **EPA** contributes significantly to climate resilience by working on projects such as the **National Adaptation Plan**[28].

- **Ministry of Water and Environment: Yemen's Ministry of Water and Environment** focuses on addressing the country's acute water scarcity, a problem exacerbated by **climate change**. The ministry develops policies to improve water management, mitigate drought impacts, and ensure water security for vulnerable communities[29].

- **National Water Resources Authority (NWRA):** The **NWRA** operates at both national and local levels, monitoring **Yemen's** water resources and implementing conservation practices. By tackling issues like over-extraction of groundwater and promoting sustainable usage, the **NWRA** helps alleviate the water crisis worsened by **climate change**[30].

## International Organizations:

- **United Nations Development Program (UNDP)**: **UNDP** supports **Yemen** through capacity-building initiatives and funding for climate resilience

[28] Environmental Protection Authority (EPA). (2021). Yemen's National Adaptation Plan. Retrieved from https://www.epa.gov.ye
[29] United Nations Development Program (UNDP). (2020). Supporting Climate Resilience in Yemen. Retrieved from https://www.undp.org
[30] National Water Resources Authority (NWRA). (2021). Water Resource Management in Yemen. Retrieved from https://www.nwra.gov.ye

projects. It also collaborates with local stakeholders to implement sustainable solutions[31].

- **Food and Agriculture Organization (FAO)**: **FAO** addresses climate-related challenges in **Yemen's** agricultural sector by promoting sustainable farming practices and improving food security[32].

## Local Non-Governmental Organizations (NGOs):

- **Yemen Climate Change Initiative (YCCI)**: A grassroots organization focusing on raising awareness and advocating for climate adaptation projects at the community level[33].
- **National Water Resources Authority (NWRA)**: **NWRA** works at the local level to monitor water usage and implement conservation measures to address water scarcity challenges exacerbated by **climate change**[34].

## Community-Based Actors:

- **Local Councils:** These councils play an essential role in coordinating disaster response efforts and mobilizing resources for climate resilience at the community level[35].
- **Farmers and Agricultural Cooperatives:** Local farmers and cooperatives are key players in implementing sustainable practices to reduce vulnerability to droughts and floods[36].

These actors collectively contribute to **Yemen's climate change** responses by addressing both immediate challenges and long-term resilience strategies.

[31] UNDP, 2020
[32] Food and Agriculture Organization (FAO). (2019). Building Climate Resilience in Yemen's Agriculture Sector. Retrieved from https://www.fao.org.
[33] Yemen Climate Change Initiative (YCCI). (2022). Community-Based Adaptation Strategies. Retrieved from https://www.ycci.org
[34] National Water Resources Authority (NWRA). (2021). Water Resource Management in Yemen. Retrieved from https://www.nwra.gov.ye
[35] World Bank. (2021). Local Governance and Climate Resilience in Yemen. Retrieved from https://www.worldbank.org
[36] Food and Agriculture Organization (FAO). (2019). Building Climate Resilience in Yemen's Agriculture Sector. Retrieved from https://www.fao.org.

# VII. Classify the main actors involved in climate change responses at national, and local levels in Yemen

Yemen's response to **climate change** involves a complex interplay of national and local actors, including **government** agencies, international organizations, and local communities.

## National Level Actors:

1. **Government Ministries and Agencies:**
    - **Ministry of Water and Environment (MWE):** Tasked with formulating and implementing environmental policies, the **MWE** plays a pivotal role in coordinating **climate change** mitigation and adaptation strategies.
    - **Ministry of Agriculture and Irrigation (MAI):** This ministry focuses on sustainable agricultural practices and water resource management, essential for addressing climate-induced challenges like desertification and water scarcity.
2. **Supreme Council for the Environment:**
    - Established to oversee environmental protection initiatives, this council is instrumental in integrating climate change considerations into national development plans.
3. **National Meteorological Center:**
    - Provides critical climate data and early warning systems to inform disaster preparedness and response efforts.

## Local Level Actors:

1. **Local Environmental Protection Authorities:**
    - Operating under the **MWE**, these bodies are responsible for implementing environmental policies at the governorate level, including **climate change** adaptation measures.
2. **Local Councils and Municipalities:**

- Tasked with urban planning and infrastructure development, local councils are key in integrating climate resilience into community planning and resource management.

3. **Community-Based Organizations (CBOs):**
    - These grassroots entities engage in environmental education, sustainable agriculture, and local disaster risk reduction initiatives, fostering community resilience to climate impacts.

## International and Non-Governmental Organizations (NGOs):

1. **United Nations Development Program (UNDP):**
    - Supports **Yemen** in developing and implementing **climate change** adaptation and mitigation projects, including capacity-building and policy development.
2. **International Organization for Migration (IOM):**
    - Focuses on strengthening community capacities to mitigate, prepare for, and respond to disasters, with an emphasis on local community participation.
3. **World Food Program (WFP):**
    - Addresses food insecurity exacerbated by **climate change** through emergency food assistance and sustainable agricultural practices.
4. **World Health Organization (WHO):**
    - Provides health support during climate-induced disasters, including medical supplies and health services.
5. **Local and International NGOs:**
    - Organizations such as the **Yemen Red Crescent Society** and various local **NGOs** play crucial roles in disaster response, environmental education, and community-based adaptation projects.

## Challenges and Coordination:

The ongoing conflict in **Yemen** has significantly hindered the effectiveness of these actors. Local authorities often lack the capacity and resources to implement **climate change** initiatives effectively. International organizations face challenges in delivering aid due to security concerns and logistical difficulties. For instance, during the **2020**

floods, local councils had limited ability to provide immediate services, and international donors, in collaboration with national **NGOs**, remained the main source of disaster assistance.

Despite these challenges, there is a concerted effort to enhance coordination among **national** and **local actors**, **international organizations**, and **communities** to build resilience against **climate change impacts**. Conferences and workshops, such as those held in **Mukalla**, aim to develop responses to environmental degradation and build capacity among local authorities.

In summary, **Yemen's climate change** response involves a multi-tiered approach with various actors at the national and local levels, each facing unique challenges but collectively working towards building resilience and sustainable development.

# VIII. The Role of Stakeholders in the Nexus Approach in Yemen

The protracted crisis in **Yemen**, marked by ongoing conflict, severe **humanitarian** needs, and underdevelopment, has necessitated a comprehensive and integrated approach to aid delivery and **peacebuilding**. The **Humanitarian-Development-Peace (HDP) Nexus** framework provides a way to address these interconnected challenges by aligning short-term **humanitarian** aid with long-term **development** and **peacebuilding** efforts. Stakeholders in **Yemen** play a pivotal role in implementing the **Nexus approach**, and their collaboration and contributions are vital to ensuring sustainable recovery for the country.

## Key Nexus Stakeholders in Yemen

The **Nexus approach** relies on a diverse array of stakeholders, each contributing unique expertise and resources. These stakeholders include international organizations, local actors, civil society groups, and donor agencies.

## International Organizations

International organizations, such as the **United Nations agencies**, are at the forefront of **Nexus-based interventions** in **Yemen**. For example:

- **United Nations Development Program (UNDP): UNDP** focuses on rebuilding essential infrastructure, enhancing livelihoods, and fostering resilience at the community level. Their projects often align development efforts with humanitarian goals, such as integrating cash-for-work initiatives into post-conflict reconstruction[37].
- **World Food Program (WFP): WFP** not only provides food assistance but also supports local food production systems and agricultural development to reduce dependency on aid[38].
- **United Nations Children's Fund (UNICEF): UNICEF** combines humanitarian aid with development by rehabilitating schools and water systems while providing immediate support to vulnerable children and families.

## Local and National Government Actors

Local governance structures are critical stakeholders in **Nexus** programming. Despite the fragmented political situation in **Yemen**, local councils and authorities often collaborate with international agencies to implement projects. For example, in **Aden** and **Hadramout**, local **governments** have worked with international donors to restore water infrastructure and healthcare services, aligning **humanitarian** aid with long-term **development** needs[39].

## Civil Society Organizations (CSOs)

Local civil society organizations are instrumental in ensuring that **Nexus** programs are context-sensitive and community-driven. **CSOs** often mediate between local communities and international agencies, providing valuable insights into local needs and priorities. For instance, the **Yemen Women's Union** has been active in supporting community-level **peacebuilding** initiatives and advocating for the inclusion of women in recovery efforts.

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[37] UNDP. (2020). The Nexus Approach in Yemen: Aligning Humanitarian and Development Goals. Retrieved from UNDP.
[38] World Food Program (WFP). (2023). Yemen: Emergency Response and Food Security. Retrieved from WFP.
[39] Yemen Climate Change Initiative (YCCI). (2022). Community-Based Adaptation Strategies. Retrieved from https://www.ycci.org.

### Donor Agencies

Donors are key stakeholders in financing **Nexus**-based projects. Major contributors include:

- **European Union (EU):** The **EU** has committed significant resources to **Nexus** programs in **Yemen**, focusing on stabilizing communities, restoring basic services, and supporting local governance[40].
- **World Bank:** The **World Bank's** engagement in **Yemen** emphasizes recovery and reconstruction, particularly in health, education, and infrastructure sectors, which align closely with the **Nexus** framework.

### Community Members and Local Leaders

Communities and traditional leaders are central to the success of the **Nexus approach**. Their participation ensures that programs are relevant and sustainable. For example: Local mediators in **Taiz** have played a critical role in resolving disputes over water resources, helping to bridge **peacebuilding** with **humanitarian** and **development** efforts[41].

## Stakeholder Contributions to the Nexus Approach in Yemen

The effective implementation of the **Nexus approach** in **Yemen** relies on coordinated efforts among stakeholders. Key contributions include:

### 1. Humanitarian Response

Stakeholders work to address **Yemen's** immediate **humanitarian** needs, such as food insecurity, healthcare, and shelter. International agencies like **WFP** and **UNICEF** provide lifesaving assistance while integrating programs that promote resilience and recovery.

### 2. Development Initiatives

**Development** actors focus on rebuilding **Yemen's** infrastructure and institutions. For instance, **UNDP** and the **World Bank** collaborate with local authorities to restore water systems and hospitals, providing a foundation for long-term stability.

[40] European Union External Action. (2023). The EU's Role in Supporting Yemen's Recovery. Retrieved from EU External Action.

[41] Saferworld. (2021). Pathways for Peace in Yemen: Localized Conflict Resolution. Retrieved from Saferworld.

### 3. Peacebuilding Efforts

**Peacebuilding** is a critical pillar of the **Nexus** approach in **Yemen**. Local organizations and community leaders often mediate conflicts over scarce resources, while international stakeholders support national-level reconciliation efforts. For example, the **Peace Support Facility**, established by **UN** agencies, funds locally-driven **peacebuilding** projects.

## Challenges Facing Nexus Stakeholders

Despite their critical roles, **Nexus** stakeholders in **Yemen** face significant challenges:

1. **Fragmented Political Landscape:** The division of **Yemen** between multiple factions makes coordination among stakeholders difficult. Local governance structures often lack the capacity to fully participate in **Nexus** programs.
2. **Funding Gaps: Humanitarian** aid in **Yemen** remains severely underfunded, and donor commitments often prioritize emergency response over long-term **development** and **peacebuilding**[42].
3. **Security Risks:** Ongoing conflict and instability frequently disrupt program implementation, particularly in remote and contested areas.
4. **Lack of Coordination:** Despite efforts to integrate **Nexus** pillars, many stakeholders continue to operate in silos, limiting the impact of their interventions.

## Recommendations for Enhancing Stakeholder Collaboration

1. **Strengthen Coordination Mechanisms: Platforms like the Yemen Humanitarian Response Plan (HRP)** and the **Yemen Humanitarian Fund (YHF)** should expand their scope to include **development** and **peacebuilding** actors, fostering greater collaboration among **Nexus** stakeholders.

[42] OCHA. (2023). Yemen Humanitarian Needs Overview.

2. **Increase Funding for Nexus Programs:** Donors should prioritize multi-year funding that supports integrated **Nexus** programming, ensuring that **humanitarian** aid transitions into **development** and **peacebuilding**.
3. **Empower Local Stakeholders:** International organizations should invest in capacity-building for local actors, enabling them to take a more active role in implementing **Nexus initiatives**.
4. **Promote Inclusive Peacebuilding: Nexus** programs must address the needs of marginalized groups, including women and displaced populations, to ensure long-term stability.

The **Nexus** approach in **Yemen** represents a critical evolution in how stakeholders address the country's overlapping crises. By integrating **humanitarian**, **development**, and **peacebuilding** efforts, the **Nexus** framework offers a pathway to sustainable recovery. However, achieving its full potential requires enhanced collaboration among stakeholders, sustained funding, and a commitment to addressing root causes of conflict. For **Yemen**, a coordinated and inclusive approach is not just an ideal—it is a necessity for building a peaceful and resilient future.

# IX. Challenges in Achieving Nexus Strategies / Objectives

## Challenges in Achieving Nexus Strategies

Implementing the **Humanitarian-Development-Peace (HDP) Nexus strategies** faces significant challenges, particularly in fragile and conflict-affected contexts such as **Yemen**. These challenges arise from the complexity of integrating diverse sectors and actors into cohesive and sustainable efforts.

### Fragmented Governance and Political Instability

In conflict-affected countries like **Yemen**, fragmented governance structures, weak institutions, and ongoing political instability undermine the coordination necessary for

**Nexus strategies**. Competing authorities and local power dynamics make it difficult to implement integrated programs effectively[43]. For example, different factions in **Yemen's governorates**, such as **Taiz**, **Marib**, and **Al-Hodeidah**, often have conflicting priorities, which hampers collaboration between stakeholders.

## Lack of Coordination Among Stakeholders

**Nexus strategies** require close collaboration between **humanitarian**, **development**, and **peacebuilding** actors. However, operational silos, differing mandates, and competing agendas among international organizations, **NGOs**, and local **governments** frequently lead to inefficiencies and duplication of efforts[44].

In **Yemen**, **humanitarian** actors often prioritize immediate life-saving needs, while development organizations focus on long-term goals, creating gaps in planning and execution.

## Inadequate and Fragmented Funding Mechanisms

Funding streams are often sector-specific, short-term, and rigid, making it challenging to implement integrated and flexible **Nexus** strategies. Multi-year funding, essential for transitioning from humanitarian relief to **development** and **peacebuilding**, is often unavailable. Donor fatigue and conflicting global crises have increased **Yemen's** finance challenges[45].

## Security and Access Constraints

Ongoing conflict and insecurity in **Yemen** severely limit access to affected populations, particularly in contested areas like **Taiz** and **Marib**. These conditions hinder the delivery of integrated programs and disrupt project timelines[46]. Aid workers and local partners are often at risk, and supply chains are frequently disrupted by violence, blockades, or bureaucratic hurdles.

[43] OCHA. (2023). Yemen Humanitarian Needs Overview.
[44] UNDP. (2023). Enhanced Rural Resilience in Yemen (ERRY) Program Overview.
[45] World Bank. (2022). Yemen Climate Impact Report.
[46] OCHA (2023). Yemen Humanitarian Needs Overview 2023. United Nations Office for the Coordination of Humanitarian Affairs. Retrieved from https://www.unocha.org

## Limited Local Capacity and Community Engagement

Effective **Nexus** strategies require strong local ownership and capacity, but in **Yemen**, years of conflict and economic collapse have weakened local institutions and governance structures. Moreover, insufficient community engagement can lead to a lack of trust and support, which undermines the sustainability of **Nexus** initiatives[47].

## Difficulty in Measuring Impact and Accountability

The complexity of **Nexus** strategies, which combine **humanitarian**, **development**, and **peacebuilding** objectives, makes it challenging to establish clear metrics for success and accountability. Regarding **Yemen**, overlapping crises such as food insecurity, displacement, and conflict make it difficult to assign outcomes to specific interventions or demonstrate measurable progress[48].

## Global and Regional Political Dynamics

Geopolitical interests and external interventions complicate the implementation of **Nexus strategies** in **Yemen**. Competing agendas among international actors often influence funding priorities and program designs, sometimes favoring short-term relief over sustainable solutions[49].

## Addressing Challenges

To address these issues, stakeholders should prioritize:

- Flexible, multi-year funding to promote integrated approaches.
- Improved coordination systems at the national and local levels.
- Investing in local capacity **development** and governance systems.
- Improved security mechanisms to ensure safe access to the affected regions.
- Comprehensive monitoring and evaluation tools for tracking progress and adjusting tactics.

[47] Oxfam. (2023). Pathways to Sustainable Recovery: Lessons from Yemen Nexus Implementation.
[48] UNICEF. (2023). Integrated Programming for Water and Sanitation in Fragile Contexts.
[49] FAO. (2023). Building Resilient Livelihoods in Yemen.

## Challenges in Achieving Nexus Objectives

The **Humanitarian-Development-Peace (HDP) Nexus** aims seek to generate long-term solutions by addressing immediate needs, encouraging **development**, and promoting peace. However, accomplishing these goals poses enormous problems, particularly in fragile and conflict-affected environments such as **Yemen**.

### Fragmented Governance and Weak Institutions

Achieving **Nexus objectives** requires strong and unified governance, but **Yemen's** fragmented political landscape complicates coordination between **humanitarian**, **development**, and **peacebuilding** efforts. Weak institutions and competing authorities, particularly in **governorates** such as **Taiz** and **Marib**, create barriers to the implementation of coherent policies and programs[50].

### Lack of Coordination Among Actors

**Nexus objectives** rely on collaboration between diverse stakeholders, including local governments, **NGOs**, international organizations, and donors. However, operational silos and differing mandates often result in misaligned priorities. Across **Yemen**, **humanitarian** actors emphasize life-saving relief, while **development** and **peacebuilding** actors target long-term solutions, resulting in gaps in achieving integrated goals[51].

### Rigid and Inadequate Funding Mechanisms

Funding for **Nexus** objectives often remains compartmentalized into short-term emergency relief or sector-specific projects, with limited flexibility to address overlapping needs. Multi-year, flexible funding—critical for achieving the transition from **humanitarian** relief to sustainable **development** and **peacebuilding**—is scarce in **Yemen** due to donor fatigue and competing global crises[52].

[50] OCHA (2023). Yemen Humanitarian Needs Overview 2023. United Nations Office for the Coordination of Humanitarian Affairs. Retrieved from https://www.unocha.org
[51] UNDP. (2023). Enhanced Rural Resilience in Yemen (ERRY) Program Overview.
[52] World Bank. (2022). Yemen Climate Impact Report.

## Security and Access Constraints

Ongoing conflict and insecurity in **Yemen**, particularly in **governorates** such as **Taiz** and **Marib**, hinder access to affected communities, delaying or preventing the implementation of **Nexus programs**. Aid workers and **development** practitioners face risks from violence, blockades, and bureaucratic obstacles, further complicating efforts to achieve **Nexus objectives**[53].

## Complexity of Addressing Root Causes

The **Nexus approach** seeks to address the core causes of crises, such as poverty, inequality, and violence, but these challenges are deeply ingrained and demand long-term commitment, which is difficult to maintain in unpredictable environments like **Yemen**. For example, addressing food insecurity in **Yemen** involves not only delivering emergency aid but also tackling systemic issues like disrupted agricultural systems and market access[54].

## Limited Local Ownership and Community Engagement

Achieving **Nexus objectives** requires strong local ownership and participation, but in **Yemen**, prolonged conflict has eroded trust in institutions and limited community engagement. Programs often lack meaningful input from local stakeholders, leading to reduced sustainability and acceptance[55].

## Inadequate Monitoring and Evaluation Mechanisms

Measuring the progress and impact of **Nexus objectives** is challenging due to their multi-dimensional nature, which combines **humanitarian**, **development**, and **peacebuilding** outcomes. Throughout **Yemen**, several crises such as displacement, food insecurity, and violence make it challenging to develop clear measures and accountability for **Nexus initiatives**[56].

[53] UNICEF. (2023). Integrated Programming for Water and Sanitation in Fragile Contexts.
[54] FAO. (2023). Building Resilient Livelihoods in Yemen.
[55] Oxfam. (2023). Pathways to Sustainable Recovery: Lessons from Yemen Nexus Implementation.
[56] UNDP. (2023). Enhanced Rural Resilience in Yemen (ERRY) Program Overview.

### Global and Regional Political Dynamics

External political and economic interests often influence the design and implementation of **Nexus programs**, sometimes prioritizing short-term goals over sustainable solutions. In **Yemen**, geopolitical rivalries and regional dynamics have exacerbated the conflict, complicating efforts to align **humanitarian**, **development**, and **peacebuilding** objectives[57].

### Addressing the Challenges

To overcome these challenges and reach **Nexus** objectives, stakeholders must develop governance and institutional capacities at both the **national** and **local** levels, as well as promote inclusive and participatory ways to assure local ownership. Aligning financial mechanisms with long-term, integrated planning is critical to supporting sustainable efforts, as is improving cooperation among players through collaborative planning and shared frameworks. Furthermore, the **development** of rigorous monitoring and evaluation mechanisms is critical for tracking progress, identifying gaps, and effectively adapting tactics, fostering a complete and unified approach to addressing linked difficulties.

## X. Towards Coherence: HDP Nexus Integration in Yemen - Challenges and Opportunities

The **Humanitarian-Development-Peace (HDP) Nexus** aims to align emergency relief, long-term **development**, and **peacebuilding** efforts in conflict-affected and fragile contexts. In **Yemen**, where a complex and protracted conflict has created one of the world's worst **humanitarian** crises, integration across these three pillars is critical to achieving sustainable solutions. However, the current level of integration among

[57] OCHA (2023). Yemen Humanitarian Needs Overview 2023. United Nations Office for the Coordination of Humanitarian Affairs. Retrieved from https://www.unocha.org

**humanitarian**, **development**, and **peacebuilding** actors in **Yemen** reveals both progress and significant gaps.

## Humanitarian, Development, and Peacebuilding Actors in Yemen

### ▪ Humanitarian Actors

**Humanitarian** organizations in **Yemen** are focusing on addressing urgent needs such as food insecurity, healthcare, and shelter, with key actors playing pivotal roles in these efforts. The **World Food Program (WFP)** provides emergency food assistance to millions of **Yemenis** monthly, helping to combat widespread hunger. **UNICEF** provides life-saving interventions for malnourished children while ensuring access to clean water and sanitation, addressing critical health and hygiene. Additionally, international **NGOs** such as **Médecins Sans Frontières** (**Doctors Without Borders**) and **Save the Children** provide essential medical care and services to displaced populations, ensuring that vulnerable communities receive the support they need amidst the ongoing crisis.

### ▪ Development Actors

To promote long-term recovery, **Yemeni development** agencies prioritize repairing vital infrastructure, restoring basic services, and strengthening community resilience. The **United Nations Development Program (UNDP)** plays an important role in reconstructing roads, water networks, and healthcare facilities, ensuring that basic services are restored in war regions. The **World Bank** participates by funding programs that attempt to reconstruct social services and strengthen local governance systems, so laying the groundwork for long-term growth. Furthermore, local groups play an important role in encouraging vocational training and conducting small-scale economic recovery projects, allowing communities to achieve self-sufficiency and economic stability.

- **Peacebuilding Actors**

**Peacebuilding** activities in **Yemen** are centered on resolving conflicts at both the national and local levels, with major actors playing important roles in promoting stability and reconciliation. The **UN Special Envoy** for **Yemen** coordinates negotiations between warring parties to reach a political settlement and end the long-running conflict. **Saferworld** and the **Yemen Women's Union** fund grassroots **peacebuilding** programs that prioritize the participation of women and marginalized groups in conflict resolution processes. Community leaders also participate by mediating resource disputes, such as those over water and grazing land, thereby reducing tensions and promoting local stability in impacted areas.

## Level of Integration: Progress and Challenges

- **Progress in Integration**

1. **Linking Humanitarian and Development Efforts:**

   The significance of merging **humanitarian** and **development** programming in **Yemen** is becoming more widely recognized in order to achieve long-term solutions. For example, the **World Food Program (WFP)** has worked with development actors to construct food security and livelihoods initiatives, giving farmers with agricultural training and inputs to help them transition from relying on food aid to self-sufficient production[58]. Similarly, the **United Nations Development Program (UNDP)** has prioritized water network rehabilitation, which supports **humanitarian** operations by lowering reliance on emergency water trucking and enabling more long-term access to clean water[59].

2. **Peacebuilding Integration at the Local Level:**

   Localized **peacebuilding** efforts in **Yemen** have had modest effectiveness in integrating with **development** and **humanitarian** programs, resulting in more cohesive and durable effects. For instance, in **Taiz** and **Hodiedah**, **Saferworld** has assisted local mediators in resolving disputes over water and grazing land. These

[58] World Food Program (WFP). (2023). Yemen: Emergency Response and Food Security. Retrieved from WFP.
[59] United Nations Development Programme (UNDP). (2020). The Nexus Approach in Yemen: Aligning Humanitarian and Development Goals. Retrieved from UNDP.

mediation initiatives have lowered tensions in communities and provided a more stable environment, allowing for the implementation of development projects and developing long-term resilience[60].

3. **Donor Support for Nexus Initiatives:**

   Some donors, such as the **European Union (EU)** and the **World Bank (WB)**, have stressed multi-sectoral approaches, supporting programs that address overlapping **humanitarian**, **development**, and **peacebuilding** needs.

## Challenges in Integration

1. **Fragmented Coordination Mechanisms:**

   Fragmented coordination mechanisms continue to provide a substantial obstacle to the efficient integration of **humanitarian**, **development**, and **peacebuilding** operations in **Yemen**, with many actors operating in silos due to competing mandates, financing streams, and agendas. **Humanitarian** players frequently prioritize rapid relief operations, whereas **development** and **peacebuilding** programs require longer timelines and stable circumstances to flourish. Furthermore, coordination platforms like the **Yemen Humanitarian Response Plan (HRP)** lack sufficient mechanisms for successfully integrating **development** and **peacebuilding** actors, limiting chances for collaborative planning and execution[61].

2. **Conflict and Instability:**

   Ongoing violence in **Yemen** continues to stymie **development** and **peacebuilding** efforts, particularly in contested areas, posing significant obstacles to progress. **Humanitarian** access is frequently restricted due to security concerns, which limits prospects for collaboration and integrated programming. For example, projects targeted at restoring critical infrastructure such as schools and health facilities are routinely delayed or canceled, weakening attempts to fulfill both immediate needs and long-term recovery goals.

[60] Saferworld. (2021). Pathways for Peace in Yemen: Localized Conflict Resolution. Retrieved from Saferworld.
[61] United Nations Office for the Coordination of Humanitarian Affairs (UN OCHA). (2023). Yemen Humanitarian Response Plan. Retrieved from UN OCHA.

3. **Funding Gaps and Donor Priorities:**

   Yemen's donor funding has largely prioritized **humanitarian** help above long-term **development** and **peacebuilding** activities, creating a huge imbalance that impedes long-term recovery. According to **UN OCHA**, Yemen's **2023 Humanitarian Response Plan** is **50%** underfunded, with even lower funding going toward **development** and **peacebuilding** projects. This financing inequality hinders stakeholders' ability to address the core causes of the crisis and build resilience, creating important gaps in efforts to support stability and long-term recovery.

4. **Lack of Inclusive Peacebuilding:**

   While local **peacebuilding** efforts have shown promise, national-level peace negotiations remain disconnected from ground realities. Marginalized groups, including women and displaced populations, are often excluded from peace processes, limiting their integration with broader **humanitarian** and **development** goals.

## Opportunities for Enhanced Integration

1. **Strengthening Coordination Mechanisms:**

   Platforms like the Yemen **Humanitarian Fund (YHF)** and **UN** Cluster System should expand to include **development** and **peacebuilding** actors, fostering joint planning and implementation.

2. **Multi-Year and Flexible Funding:**

   Donors should prioritize multi-year funding that bridges **humanitarian** and **development** efforts, enabling actors to address immediate needs while building resilience.

3. **Scaling Up Local Integration Efforts:**

   Successful community-level programs, such as local dispute resolution initiatives, should be scaled up and linked with national-level **peacebuilding** and **development** strategies.

4. **Incorporating Climate Adaptation into Nexus Programming:**
   Addressing climate-related challenges, such as water scarcity and desertification, offers a natural entry point for integrating **humanitarian**, **development**, and **peacebuilding** efforts in **Yemen**.

The integration between **humanitarian**, **development**, and **peacebuilding** actors in **Yemen** remains a work in progress. While there have been successes in linking **humanitarian** and **development** efforts, and localized **peacebuilding** initiatives have shown promise, significant challenges persist. To achieve meaningful integration, stakeholders must address coordination gaps, secure sustained and balanced funding, and ensure that **peacebuilding** efforts are inclusive and grounded in local realities.
The **HDP Nexus** framework offers a pathway to a more sustainable and cohesive response to **Yemen's** crisis, but its success will depend on the commitment of all stakeholders to work collaboratively and holistically.

# XI. Tackling Climate Change in Yemen: A Collaborative Effort Across Actors

**Yemen**, one of the most vulnerable countries to **climate change**, faces severe challenges such as water scarcity, desertification, and extreme weather events. These issues are compounded by ongoing conflict, making climate resilience a critical necessity. Addressing **Yemen's** climate crisis requires coordinated efforts from various stakeholders, each contributing through mitigation, adaptation, advocacy, policymaking, funding, and innovation. Below is an overview of the roles and actions undertaken by different actors in **Yemen**.

## International Organizations

International organizations play a pivotal role in addressing **Yemen's** climate challenges through mitigation, adaptation, advocacy, funding, and innovation. Organizations such as the **United Nations Development Program (UNDP)** and the **Food and Agriculture Organization (FAO)** are actively combating desertification,

restoring degraded lands, and promoting sustainable agricultural practices to reduce carbon emissions and environmental degradation. Initiatives like **FAO's** Farmer Field Schools educate farmers on minimizing environmental impacts, thereby reducing deforestation and enhancing soil conservation[62]. Adaptation efforts led by **UNDP** and the **United Nations Environment Program (UNEP)** focus on building climate-resilient infrastructure, training farmers to grow drought-resistant crops, and improving water management, exemplified by the "**Enhanced Rural Resilience in Yemen" (ERRY) project**, which strengthens water access and food security[63]. Advocacy by global organizations, including the **UNFCCC** and the **World Bank**, highlights **Yemen's** vulnerability to climate-induced disasters, as seen in **Yemen's** inclusion in the **Global Climate Risk Index**, which drives funding and policy attention[64]. Financial support from entities like the **Green Climate Fund (GCF)** and the **World Bank** enables grassroots adaptation measures, such as community-based water projects that mitigate drought impacts[65]. Moreover, innovation projects, such as **UNDP's** introduction of solar-powered water pumps and microgrids, provide sustainable energy solutions while reducing reliance on fossil fuels[66]. Together, these efforts address both immediate and long-term climate resilience needs in **Yemen**.

## National Government Bodies

**National government** bodies in **Yemen** play a critical role in climate policy, mitigation, adaptation, and advocacy, despite significant challenges posed by conflict and weak governance. Through its **National Adaptation Program of Action (NAPA)**, the **government** prioritizes water resource management, sustainable agriculture, and disaster risk reduction, with the **Ministry of Water and Environment** leading efforts to integrate climate adaptation into national strategies[67]. Mitigation efforts, often supported by international organizations like **FAO**, focus on reducing deforestation

[62] https://www.fao.org/environmental-social-safeguards/project-detail/resilient-and-sustainable-livelihoods-for-rural-yemen/en?utm_source=chatgpt.com
[63] https://annualreport.undp.org/2022/index.html?utm_source=chatgpt.com
[64] https://www.germanwatch.org/en/19777?utm_source=chatgpt.com
[65] https://www.greenclimate.fund/projects?utm_source=chatgpt.com
[66] https://www.undp.org/yemen/publications/solar-interventions-yemen?utm_source=chatgpt.com
[67] Republic of Yemen. (2009). *Yemen National Adaptation Programme of Action (NAPA)*. United Nations Development Programme (UNDP).

and promoting sustainable land use, which helps lower emissions from agriculture and prevent further environmental degradation[68]. To address water scarcity, the **government** has initiated small-scale irrigation projects and established the **National Water Resources Authority** (**NWRA**) to oversee water resource allocation, though institutional weaknesses and resource limitations hinder progress[69]. On the advocacy front, **Yemen** actively seeks regional and international climate finance, leveraging platforms like the **Arab League** to highlight the disproportionate impacts of climate change and build regional partnerships for action[70]. These efforts lay the groundwork for coordinated climate responses, though substantial challenges remain in achieving effective implementation.

## Local Communities

**Local communities** in **Yemen** are at the forefront of climate adaptation, employing indigenous knowledge and innovative solutions to address environmental challenges. Traditional practices, such as rainwater harvesting, constructing terraces to prevent soil erosion, and cultivating drought-resistant crops, play a vital role in strengthening resilience against drought and desertification[71]. Alongside these practices, communities have adopted modern technologies like solar-powered irrigation systems and water-saving techniques to combat water scarcity. For instance, farmers in **Hadhramout** and **Taiz** utilize solar-powered pumps for irrigation, reducing dependency on fuel imports and mitigating environmental damage[72]. These combined efforts highlight the importance of community-driven initiatives in enhancing climate resilience.

[68] Food and Agriculture Organization of the United Nations. (2021). Resilient and Sustainable Livelihoods for Rural Yemen. FAO. Retrieved from https://openknowledge.fao.org/handle/1832/105984

[69] United Nations Development Programme. (2022). Water Resources Challenges in Yemen. UNDP.

[70] United Nations Office for the Coordination of Humanitarian Affairs. (2022). Yemen Humanitarian Response Plan 2022 (April 2022) [EN/AR]. United Nations Office for the Coordination of Humanitarian Affairs.

[71] United Nations Development Program. (2023). *Supporting climate resilient agriculture in Yemen*. UNDP.

[72] United States Agency for International Development. (2023). *Enterprising Woman Farmer Sees the Light, Invests in Climate-smart Green Energy*. USAID.

## Non-Governmental Organizations (NGOs)

**Non-governmental organizations (NGOs)** play a crucial role in **Yemen's** climate resilience through mitigation, adaptation, and advocacy. Organizations like **CARE International** and **Oxfam** implement small-scale reforestation projects and promote energy-efficient technologies to reduce emissions and protect ecosystems, mitigating the environmental impact of deforestation and unsustainable practices[73]. **NGOs** also enhance local adaptation efforts by building water storage facilities and training farmers in sustainable practices; for instance, **CARE's** resilience programs in **Lahj governorate** support drought-affected communities, reducing their vulnerability to climate shocks[74]. Additionally, **NGOs** advocate for global climate justice by raising awareness of **Yemen's** minimal contribution to global emissions but high exposure to climate risks, strengthening calls for international climate finance and action. Through these efforts, **NGOs** significantly contribute to addressing **Yemen's** climate challenges.

## Private Sector

The private sector in **Yemen** plays a vital role in addressing climate challenges through innovation and funding. Companies are introducing renewable energy solutions, such as solar panels, to tackle energy scarcity and promote environmental sustainability. Local firms, for example, supply affordable solar kits to households and farmers, expanding access to clean energy while reducing emissions[75,76]. Additionally, the private sector supports adaptation initiatives by providing micro-loans to farmers for investing in water-efficient technologies, empowering communities to adopt sustainable practices. These efforts highlight the sector's potential to drive climate resilience through both technological and financial support.

[73] Oxfam Australia. (n.d.). *Yemen crisis*. Oxfam Australia. Retrieved from https://www.oxfam.org.au/what-we-do/humanitarian-emergencies/yemen-crisis/

[74] CARE International. (2022). *CARE Yemen Annual Report FY 22*. CARE International. https://www.care-international.org/our-work/where-we-work/yemen?utm_source=chatgpt.com

[75] International Renewable Energy Agency. (2022). Renewable Capacity Statistics 2022. IRENA.

[76] International Energy Agency. (n.d.). Yemen - Countries & Regions. IEA.

# XII. Combating Climate Change in Yemen: Roles of Key Actors

Yemen confronts considerable hurdles in tackling **climate change**, with many interconnected players working to mitigate its effects. The Yemeni **government** has recognized water resources, agriculture, and coastal zones as particularly vulnerable sectors, and is working to encourage sustainable water usage, safeguard agricultural diversity, and establish sustainable agricultural initiatives[77]. The **United Nations Development Program (UNDP)** plays an important role in empowering Yemeni **women** to participate to global climate action through projects such as the **Youth Leadership Program**. Local authorities in Yemen have also played an important role in reacting to environmental degradation, emphasizing the need for targeted climate action[78].

International institutions such as the **World Bank** have examined the effects of **climate change** on Yemen's water and agricultural sectors and made policy suggestions to strengthen resilience[79]. Civil society and local communities are actively working to prevent the negative consequences of climate change by implementing adaption techniques such as sustainable water management and agricultural practices[80]. Despite these efforts, Yemen's political instability and fragmented governance pose substantial hurdles, impeding full compliance with international climate agreements and isolating the country from global climate finance programs[81]. Nonetheless, active participation by local authorities, civil society, and foreign partners offers an opportunity to strengthen Yemen's climate resilience through collaborative efforts.

[77] UNDP. (2021). Building Climate Resilience in Yemen. Retrieved from https://www.undp.org
[78] Reliefweb UNHCR. (2021). Climate Change, Displacement, and Vulnerability in Yemen. Retrieved from https://www.unhcr.org
[79] World Bank. (2021). Climate Risk Profile: Yemen Retrieved from https://climateknowledgeportal.worldbank.org
[80] https://www.yemenpolicy.org/?utm_source=chatgpt.com
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# List of Acronyms

| | |
|---|---|
| AI | – Artificial Intelligence |
| BBC | – British Broadcasting Corporation |
| BMZ | – Federal Ministry for Economic Cooperation and Development |
| CBOs | – Community-Based Organizations |
| CARE | – Cooperative for Assistance and Relief Everywhere |
| CSOs | – Civil Society Organizations |
| EPA | – Environmental Protection Authority |
| ESA | – European Space Agency (Europe) |
| EU | – European Union |
| EWS | – Early Warning Systems |
| FAO | – Food and Agriculture Organization of the United Nations |
| FEMA | – US Federal Emergency Management Agency |
| GCF | – Green Climate Fund |
| GHG | – Greenhouse Gas |
| GIS | – Geographic Information Systems |
| GPM | – Global Precipitation Measurement |
| HDP | – Humanitarian-Development-Peace |
| HEC-RAS | – Hydrologic Engineering Center - River Analysis System |
| HRP | – Humanitarian Response Plan |
| ICRC | – International Committee of the Red Cross |
| IDP | – Internally Displaced Person |
| IDPs | – Internally Displaced Persons |
| ILO | – International Labour Organization |
| IOM | – International Organization for Migration |
| IoT | – Internet of Things |
| KPIs | – Key Performance Indicators |
| MAI | – Ministry of Agriculture and Irrigation |
| M&E | – Monitoring and Evaluation |
| MEL | – Monitoring, Evaluation, and Learning Systems |
| MWE | – Ministry of Water and Environment |
| NAPA | – National Adaptation Program of Action |
| NASA | – National Aeronautics and Space Administration (United States) |
| NGOs | – Non-Governmental Organizations |

**(Cont.)**

| | |
|---|---|
| NWRA | – National Water Resources Authority |
| OCHA | – United Nations Office for the Coordination of Humanitarian Affairs |
| OECD-DAC | – Organization for Economic Co-operation and Development - Development Assistance Committee |
| PDA | – Peace and Development Association |
| PPPs | – Public-Private Partnerships |
| ROY | – Republic of Yemen |
| RS | – Remote Sensing |
| SDGs | – Sustainable Development Goals |
| ToT | – Training of Trainers |
| UN | – United Nations |
| UNDP | – United Nations Development Program |
| UNEP | – United Nations Environment Program |
| UNFCCC | – United Nations Framework Convention on Climate Change |
| UNICEF | – United Nations International Children's Emergency Fund |
| USAID | – United States Agency for International Development |
| US or USA | – United States of America |
| WB | – World Bank |
| WFP | – World Food Program |
| WHO | – World Health Organization |
| WMO | – World Meteorological Organization |
| WWF | – World Wide Fund for Nature |
| YCCI | – Yemen Climate Change Initiative |
| YHF | – Yemen Humanitarian Fund |
| YNI | – Yemen Nexus Initiative |

# Executive Summary

**Yemen's** landscape is dominated by arid and semi-arid conditions, with significant geographical variation across its five ecological zones: coastal plains, temperate highlands, high plateaus, desert interiors, and the islands' archipelago. The country experiences a monsoon-influenced climate, with distinct rainy and dry seasons that vary regionally.

**Climate change** is compounding these challenges, with increasing extreme weather events such as floods, droughts, and storms exacerbating displacement and environmental degradation. **IDP** camps, in particular, are highly vulnerable, with **45%** of sites at risk of flooding, leading to frequent secondary displacement.

The country has two main rainy seasons: Saif (April-May) and Kharif (July-September), with significant rainfall variations across regions. Recent extreme weather events, such as the July floods, have severely impacted western **governorates** like **Al-Hodeidah**, **Hajjah**, and **Taiz**, displacing thousands and damaging infrastructure.

**Yemen** lies at the crossroads of **climate change**, **humanitarian** crises, **development** challenges, and **peacebuilding** efforts. Consequently, **Yemen** is confronting one of the world's most acute **humanitarian** crises, with approximately **20.7 million** people in need of assistance and **4.3 million** internally **displaced people (IDPs)** as of **2021**.

With rising temperatures, more frequent droughts, water scarcity, and extreme weather events, the country is facing an accelerating crisis that threatens food security, displaces populations, and exacerbates resource-driven conflict. Addressing these difficulties requires a comprehensive and coordinated strategy that incorporates climate adaptation into **humanitarian**, **development**, and **peacebuilding (HDP) initiatives**, often known as the Nexus method.

While **humanitarian** aid remains the dominant focus for many organizations, followed closely by **development** and **peacebuilding** efforts, weak coordination across these

sectors limits the effectiveness of long-term resilience-building initiatives. **Climate change** is recognized as a major driver of displacement and conflict, yet only half of the organizations actively address it through adaptation strategies such as climate-smart agriculture, water management, and disaster risk reduction. Despite the urgent need for climate resilience, only a small fraction of organizations systematically measures the impact of their programs, highlighting a significant gap in monitoring and evaluation efforts. Additionally, financial constraints remain the most significant challenge, with the majority citing financing shortfalls as a barrier to long-term adaptation and resilience-building.

For the **Nexus approach** to deliver sustainable impact, organizations and policymakers must focus on stronger coordination, innovative funding mechanisms, and local capacity-building. Enhancing cross-sector collaboration through joint coordination platforms and improved data-sharing can increase efficiency and impact. Securing sustainable climate financing requires shifting from short-term emergency relief to multi-year resilience-building initiatives while promoting **public-private partnerships (PPPs)** for climate adaptation investments. Strengthening local adaptation strategies by supporting community-led climate initiatives and training programs will equip local institutions with the tools needed for climate-resilient policies. Furthermore, improving climate data collection and monitoring through **GIS**, **remote sensing**, and standardized impact assessment frameworks will help measure progress and ensure accountability.

To assess the **Nexus of climate change impacts on water, energy, and food security**, six key governorates have been identified based on their diverse geographical and socio-economic characteristics:

1. **Hadramout** – Faces severe water scarcity and agricultural sustainability challenges.
2. **Marib** – Historically significant for water management, with modern-day water resource vulnerabilities.
3. **Aden** – A coastal urban hub facing risks from sea-level rise, flooding, and freshwater salinization.

4. **Al-Hodeidah** – A major agricultural region affected by rising temperatures and water insecurity.
5. **Hajjah** – Experiences seasonal flooding and landslides, exacerbating humanitarian concerns.
6. **Taiz** – A densely populated conflict-affected area where **climate change** worsens water and food insecurity.

As **Yemen** continues to struggle with both environmental and **humanitarian** crises, **integrated climate adaptation and resilience strategies** are critical to mitigating the worsening impacts on communities and infrastructure.

# Preface

This paper is divided into three sections, each addressing an important component of **climate change** and the **Nexus** strategy in **Yemen**. It intends to give a complete overview of the country's environmental concerns while also investigating potential responses that combine water, energy, and food security.

**Part One:** establishes the groundwork for the study by explaining the **Nexus** idea and its application to **Yemen's** distinct socio-environmental landscape. This section focuses on the theoretical framework and background required to understand how interconnected systems work in addressing resource management concerns.

**Part two:** examines the effects of **climate change** in six **governorates**: **Hadramout**, **Marib**, **Aden**, **Al-Hodeidah**, **Hajjah**, and **Taiz**. It investigates how **climate change** influences water availability, food production, and energy access in these areas. This section also looks at **Nexus**-based actions that can help to reduce climate risks and increase resilience.

**Part three:** offers' findings from an online questionnaire study of **Yemeni** local groups. This section examines major findings from stakeholders involved in climate adaptation and resource management, providing a localized perspective on the viability and efficacy of **Nexus**-based approaches. This section finishes with major suggestions that outline concrete solutions for improving **climate resilience** and sustainable resource management in **Yemen**.

The present study aims to add to **Yemen's** continuing discourse on **climate resilience** and sustainable development. By combining empirical findings with stakeholder viewpoints, we would like to advise policies and initiatives that solve the country's pressing environmental and **humanitarian** concerns.

We extend our gratitude to all contributors that participate the online questionnaire. Their valuable insights and cooperation have been instrumental in shaping this study.

# PART III

# Nexus Approach & Climate Change Impacts

# Introduction: Yemen's Climate

**Yemen's** landscape comprises a predominantly desert climate, characterized by arid conditions. It is positioned at the southern tip of the **Arabian Peninsula** and has a surface area of approximately **527,970 square kilometers**[1] (**Fig. 1**)

**Yemen's** climate ranges from semiarid to arid-tropical, with significant geographical variation. The five main ecological zones are coastal plain, temperate highlands, high plateau, desert interior, and the islands' archipelago[2]. In general, winters in the high plateau can be frigid (below **0°C**), whereas summers are mild and dry. "**Monsoon** climate patterns determine the seasons, with winter (**December** to **March**) and

[1] **International Organization for Migration (IOM).** (2021). *Report on Migration, Environment, and Climate Change in Yemen.*
[2] *USAID, 2016*.

summer (**June to September**) representing various monsoon seasons. Spring (**April to May**) and fall/autumn (**October to November**) are transitional periods between seasons"[3].

**Yemen** is one of the world's greatest humanitarian crises, with an estimated **20.7 million** people in need of aid by the end of **2021**, including **4.3 million** internally displaced individuals (**IDPs**)[4]. More than **377,000** individuals were relocated in **2021** alone. Over **half** a **million** (**518,167**) disaster displacements were registered between **2008** and **2021**, with flooding and storms being the most common causes. **Yemen** also has **95,815 refugees** and **asylum seekers**, primarily from **Somalia** and **Ethiopia**[5].

The climate catastrophe is exacerbating **Yemen's humanitarian** and displacement crises, and it is expected to worsen further as extreme rainfall and flooding, as well as drought and other risks, become more regular and severe. The violence is also leading to environmental deterioration, such as deforestation as a result of fuel shortages caused by blockades and restrictions[6], which may have long-term negative consequences for the country's growth and may force further migration. Rapid urbanization has also caused environmental degradation in **Yemen's** cities[7].

**IDP** camps in **Yemen** are especially vulnerable to extreme weather events like flooding, because to poor infrastructure and weak disaster risk reduction procedures that do not account for the effects of **climate change**. Floods may swiftly destroy the little infrastructure in camps, while heatwaves leave people with few alternatives for cooling and shelter. A recent flood risk score for **IDP** sites in **Yemen** revealed that **307** sites were at high risk of flooding, **23** were at **medium/high** risk, and **338** were at medium risk, implying that over half (**45%**) of **IDP** sites are at danger[8]. Floods in **Marib** province in **2020**, for example, destroyed the tents and assets of **1,340** families in **Yemen's** displaced people camps, whereas flooding in **2013** affected over **8,000 IDPs** in camps and destroyed local infrastructure such as latrines, schools, and a health

[3] Republic of Yemen, 2013
[4] IDMC, 2022
[5] UNHCR, 2022
[6] Islamic Relief, 2022
[7] Republic of Yemen, 2018
[8] REACH/CCCM, 2022

clinic. Secondary displacement is a growing issue in **Yemen**, as previously displaced individuals are moved again due to conflict and/or climate disasters[9]. People who have been displaced are more likely to settle in hazard-prone areas of cities or regions, frequently in informal settlements, increasing the likelihood of being compelled to relocate again[10]. This is a particularly serious issue because displacement may have harmed or destroyed social networks and assets, leaving displaced persons with less means for coping or adapting. While climate conditions influence migration between **Yemeni districts**, the majority of migration is driven by socioeconomic concerns, with the poorest generally lacking the means to relocate.

**Yemen** typically has two primary rainy seasons, with rainfall patterns differing widely between locations. In the highlands, the rainy seasons are **Saif** (**April-May**) and **Kharif** (**July-September**). Rainfall along the shore is primarily concentrated during the winter months **(December-March)**[11]. The impact of this rainy season, which began in July, has killed at least **45** people and affected over **37,700** others, with the **western governorates** of **Al-Hodeidah**, **Hajjah**, and **Taiz** bearing the brunt of the affected **districts** and individuals. The highlands and traditionally flood-prone locations, such as **Al-Hodeidah**, **Amran**, and **Taiz**, are particularly vulnerable to flooding and its effects during the current **Kharif** season.

## Significant Governorates for Climate Change and Nexus Study in Yemen.

The selection of the six **governorates** highlighted in blue— **Al-Hodeidah**, **Hajjah, Taiz**, **Aden**, **Marib**, and **Hadramout** —represents a strategic choice for studying the **Nexus** of **climate change** and its impacts on water, energy, and food security in **Yemen** (**Fig.2**). These **governorates** are chosen based on their diverse geographical, climatic, and socio-economic characteristics:

1. **Hadramout**: As the largest **governorate** in **Yemen**, **Hadramout** encompasses arid and semi-arid landscapes with critical challenges in water scarcity and

[9] IDMC, 2022
[10] IDMC, 2018
[11] WB, 2010

sustainable agriculture. Its vast desert areas and dependency on groundwater make it highly vulnerable to climate-induced changes.


Fig. 1: Geographic location map of **Republic Of Yemen (ROY)**. (Source: **the author**).

2. **Marib**: Known for its **historic role** in **Yemen's** water management through the ancient **Marib Dam**, this governorate is critical for studying the impact of **climate change** on water resources and agricultural productivity. The modern-day **Marib Dam** plays a key role in food production and livelihoods.

3. **Aden**: As a coastal **governorate** and the temporary capital of **Yemen**, **Aden** faces unique challenges from sea-level rise, coastal flooding, and salinization of freshwater resources. Its urban nature provides insight into how climate change impacts densely populated areas and infrastructure.

4. **Al-Hodeidah**: Situated on the **Red Sea** coast, **Al-Hodeidah** is significant for analyzing the effects of rising temperatures, declining rainfall, and the

vulnerability of coastal ecosystems. Its role as a major agricultural region highlights the **Nexus** between water security and food production.

5. **Hajjah**: With a diversified geography that encompasses highlands and coastal plains, this **governorate** is especially vulnerable to seasonal flooding and landslides. The interaction of extreme weather occurrences with persistent humanitarian difficulties in **Hajjah** emphasizes the crucial need for resilience-building programs and sustainable resource management.

6. **Taiz**: This **governorate** represents a densely populated and conflict-affected area, where climate change exacerbates existing vulnerabilities in water access and agricultural livelihoods. **Taiz** provides a unique context for studying the interplay between socio-economic stress and climate impacts.

These **governorates** cover a variety of environmental and socioeconomic situations, offering a comprehensive view of **climate change** and the **Nexus** in **Yemen**.

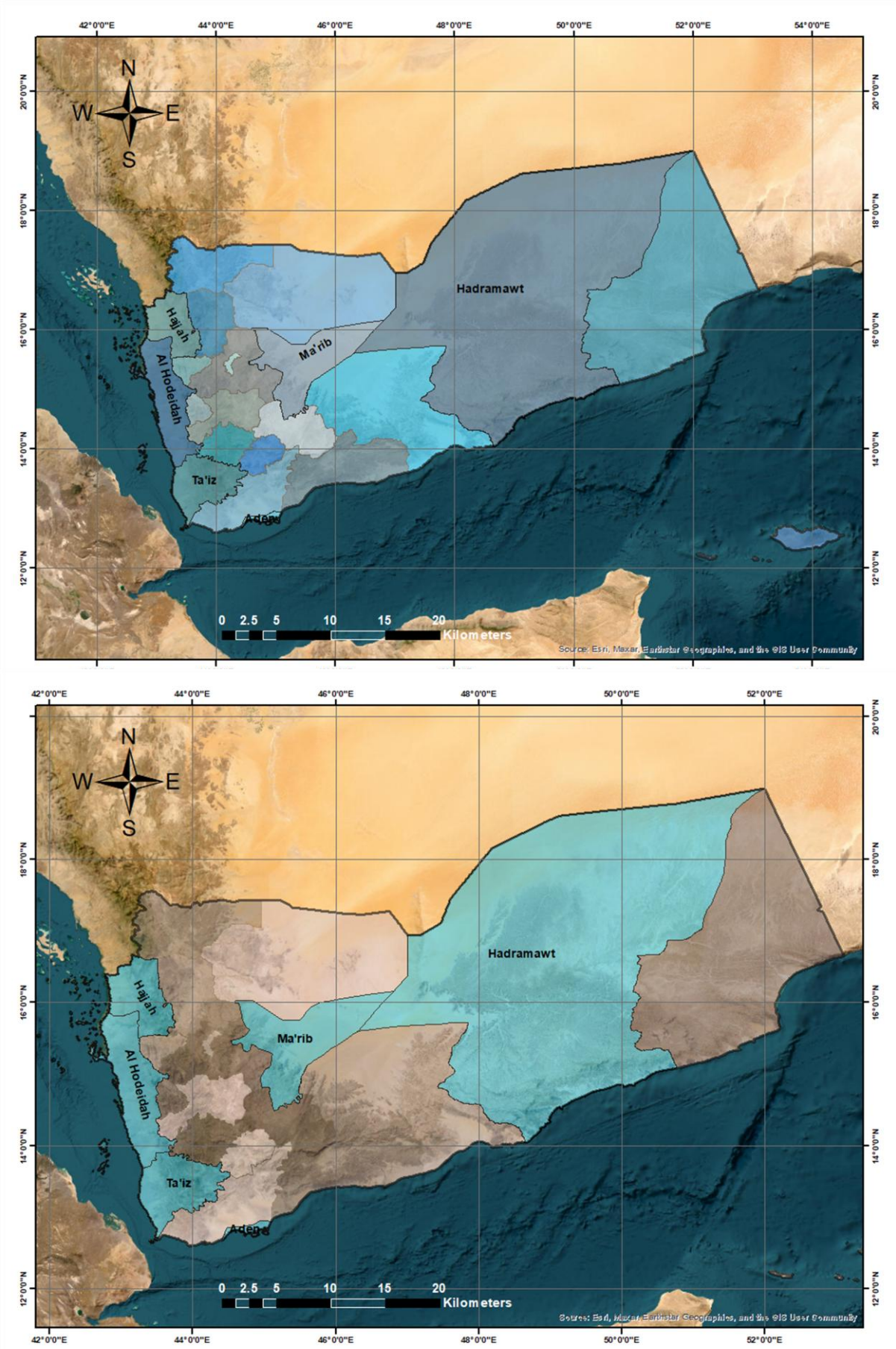


**Fig. 2**: ***Upper***: governorates of **Yemen**; ***Lower***: depicts the **6** selected **governorates** (cyan color). (Source**: the author**).

# Hodeidah Governorate

# I. Climate Change Impacts: Al-Hodeidah

## I.1. Overview

Monitoring **climate change** successfully necessitates a combination of modern approaches for tracking environmental changes and forecasting future consequences. **Remote sensing** via satellites, such as those run by **NASA** and **ESA**, offers crucial information on temperature, sea-level rise, and vegetation changes[12]. Ground-based observation networks, which include meteorological stations, track local weather, atmospheric composition, and water resources[13]. **Climate modeling**, using modern computer tools, simulates long-term climate patterns to guide policy and mitigation efforts[14]. **Geographic Information Systems** (**GIS**) are essential for analyzing geographical data, mapping sensitive areas, and detecting trends[15]. Furthermore, citizen science programs and **Internet of Things** (**IoT**) devices improve data collecting, allowing for real-time monitoring and increased interaction[16]. Together, these techniques serve as the foundation for climate monitoring efforts, assisting with worldwide adaptation and mitigation actions. Earth observation can aid in critical **humanitarian** tasks like disaster management and risk assessment. Historical climate

12 WMO (2021). "Enhancing Early Warning Systems with Earth Observation Data." World Meteorological Organization.

13 IPCC (2021). "Climate Change 2021: The Physical Science Basis." Intergovernmental Panel on Climate Change.

14 NASA (2021). "Earth Observing System Data and Information System (EOSDIS)." National Aeronautics and Space Administration.

15 UNEP (2021). "Harnessing GIS for Climate Action." United Nations Environment Program.

16 Earthwatch Institute (2020). "The Role of Citizen Science in Climate Monitoring.

data, satellite image monitoring, and digital spatial maps are all useful resources for disaster management and risk reduction.

The utilization of **Earth observation data** enables the development of **early warning systems** that are crucial for saving lives during natural disasters. For instance, satellites provide real-time detection of storms, wildfires, and floods, offering essential information to emergency responders for timely action[17] [18].

According to the **World Meteorological Organization (WMO)**, satellite-based monitoring enhanced the accuracy of cyclone predictions by **20%** over the past decade[19]. Furthermore, historical climate data provides a better understanding of long-term environmental patterns, which aids in risk assessment. For example, drought-prone areas can be detected using decades of precipitation data, allowing **governments** to better manage water resources. Smith et al. (**2020**)[20] found that combining historical satellite data with ground observations reduced agricultural losses in **sub-Saharan Africa** by **15%** during droughts.

Digital spatial maps derived from **Earth observation data** also play a critical role in disaster planning and recovery. **High-resolution satellite images** enable the construction of precise risk maps, assisting urban planners and policymakers in identifying regions prone to landslides, floods, and other hazards. In **Nepal**, for example, satellite-generated damage assessments considerably accelerated post-earthquake rehabilitation operations[21]. These enhancements underline the necessity of leveraging **Earth observation technologies** to build resilience and reduce the effect of natural disasters. By incorporating these technologies into national disaster management frameworks, communities may better plan for and respond to **humanitarian** disasters.

[17] WMO (2021). "State of the Climate in 2021." World Meteorological Organization.

[18] NASA (2021). "Satellite Technology for Disaster Management." National Aeronautics and Space Administration.

[19] World Meteorological Organization (WMO). (2022). Enhancing Cyclone Prediction Accuracy with Satellite Monitoring. *WMO Bulletin*, 71(2), 12-18.

[20] Smith, J., Brown, K., & Taylor, R. (2020). Integrating Satellite and Ground Observations for Agricultural Risk Reduction in Sub-Saharan Africa. Journal of Climate Resilience, 15(3), 45-60.

[21] UNOSAT. (2015). Satellite Imagery for Post-Earthquake Damage Assessment in Nepal. Retrieved from https://www.unitar.org/unosat

In **2020**, **Al-Hodeidah governorate** in **Yemen** (**Fig. 3**) faced two major flood events that caused significant damage and displacement. In **April**, heavy rainfall led to severe flooding, displacing over **6,000** families and causing extensive infrastructure damage. However, the exact number of fatalities remains unclear, with some reports suggesting **30** deaths, though this figure may correspond to a different time frame[22]. In **July**, another bout of flooding caused widespread destruction, including over **16** reported fatalities and significant damage to homes, infrastructure, and agricultural land, further worsening the humanitarian crisis[23]. The floods impacted both residents and internally displaced persons (**IDPs**), with the **International Organization for Migration** (**IOM**) recording nearly **1,200** displaced households and the **United Nations Office for the Coordination of Humanitarian Affairs** (**OCHA**) reporting that **3,638** families were affected during this period (**USAID**, **FloodList**). These events highlight the devastating impact of recurring floods on **Al-Hodeidah's** population and infrastructure.

## I.2. Historical Data Analysis

**Climate Historical Data Analysis** involves examining past climate records, such as temperature, precipitation, and extreme weather events, to identify trends, patterns, and anomalies over time. This analysis uses techniques like statistical modeling, **geostatistics**, and data visualization to assess long-term climate variability and its impacts.

**Benefits:**

1. **Trend Identification**
2. **Risk Assessment**
3. **Policy Planning**
4. **Resource Management**
5. **Disaster Preparedness**

[22] International Organization for Migration (IOM). (2020). Yemen: Flooding Overview and Response. Retrieved from https://www.iom.int

[23] Humanitarian Outcomes Monitoring and Evaluation (HOME). (2020). Impact of 2020 Floods in Al Hudaydah, Yemen. Retrieved from https://www.humanitarianoutcomes.org

Climate historical data analysis is reviewing previous records, such as rainfall data, to find trends, patterns, and anomalies. It employs statistical modeling and **geostatistics** to examine long-term climate variability and its consequences. This analysis provides advantages such as recognizing patterns, analyzing risks, informing policy, managing resources, and improving catastrophe preparedness.

The graphic in **Figure 4** depicts total precipitation (in **millimeters**) from **2017** to **2023** using **TerraClimate** data, indicating significant fluctuation in yearly rainfall. Notably, **2018** and **2020** show higher total precipitation, with values exceeding **55 mm**, indicating wetter years. However, starting in **2021**, there is a noticeable decline in precipitation, with **2023** experiencing the lowest levels, suggesting a drying trend or reduced rainfall. The color coding, with blue bars for above-average precipitation and red bars for below-average years, illustrates the variability in rainfall over time. These shifts between wetter and drier years reflect broader climate variability, with potential impacts on agriculture, water resources, and ecosystems.

The precipitation chart (**Fig. 5**) illustrates rainfall trends from **January 2017** to **December 2023**, measured in millimeters (**mm**). The data reveals fluctuating patterns with periods of low precipitation interspersed with occasional spikes in rainfall. A significant peak is observed around early **2020**, exceeding **120 mm**, which indicates a major rainfall event during that period, while smaller peaks are noted toward **2022** and **2023**. For most of the timeframe, precipitation levels remain low, often below **20 mm**, reflecting arid or semi-arid conditions. Although the chart does not explicitly highlight seasonal cycles, periodic increases in rainfall suggest possible seasonal patterns. These observations provide valuable insights into rainfall variability and can be useful for assessing the impact of extreme weather events on agriculture, water resources, and infrastructure.

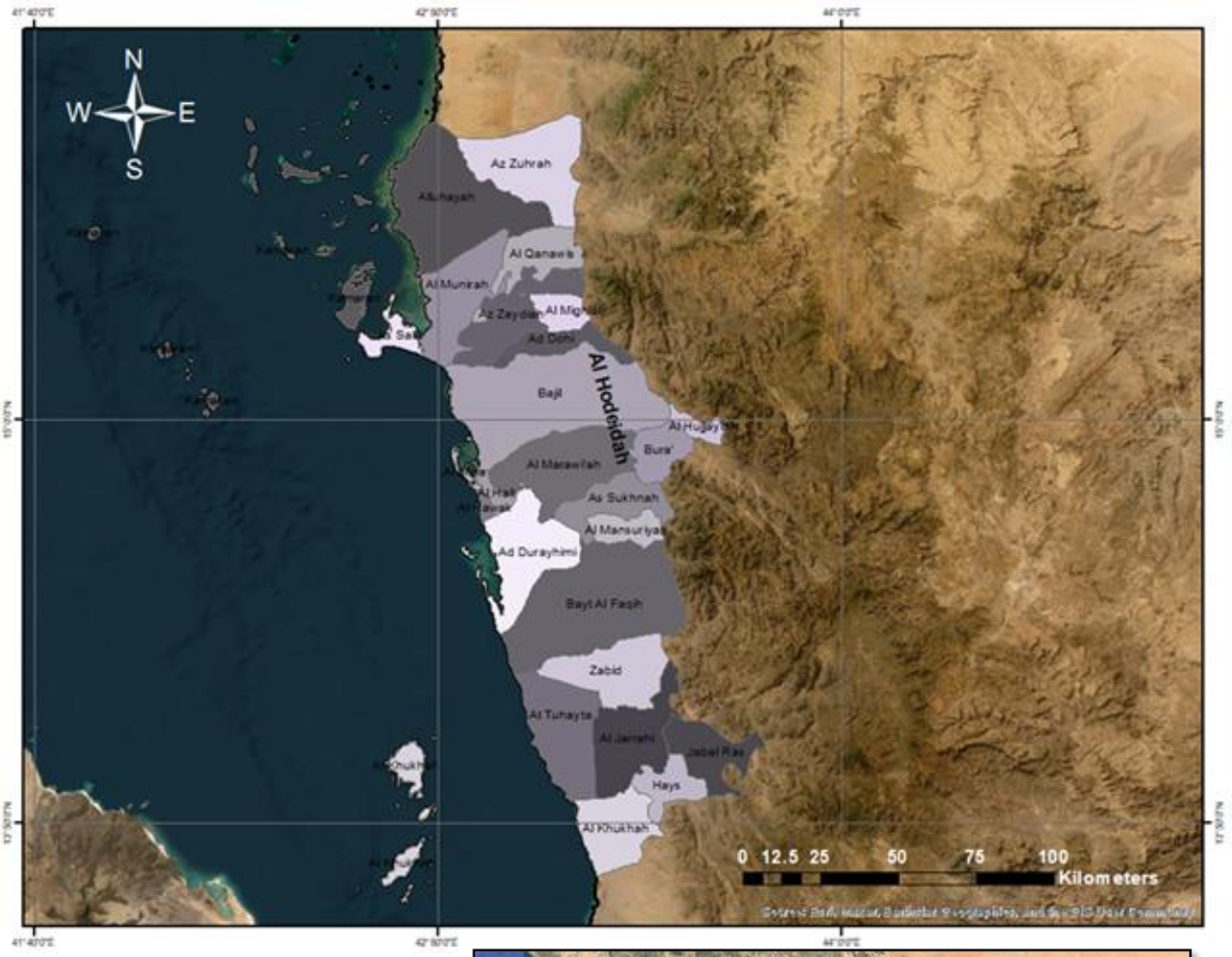



**Fig. 3**: ***Upper***: depicts the districts off **Al-Hodeidah governorates**. ***Lower***: the image depicts the bounded area (blue color) for climate analysis. (Source: **the author**).

## Key Insights from Precipitation Analysis:

1. **Rainfall Variability**: Both figures indicate significant fluctuations in precipitation over time, with periods of high rainfall interspersed with extended periods of low precipitation. This highlights a variable climate pattern in the region.

2. **Extreme Rainfall Events**: Figure 4 (line chart) reveals extreme rainfall events, particularly around early **2020**, where precipitation exceeded **120 mm**. These events point to the occurrence of intense, short-duration storms or heavy rainfall periods.

3. **Declining Rainfall Trends**: Figure 5 (bar chart) suggests a declining trend in total annual precipitation, particularly from **2021** to **2023**, with **2023** showing the lowest levels. This could indicate a drying trend or increasing water scarcity in recent years.

4. **Seasonal and Annual Variability**: Both figures demonstrate seasonal and annual variability, with significant peaks and troughs in precipitation levels. Such variability underscores the challenges of managing water resources and planning agricultural activities in the region.

5. **Potential Climate Impacts**: The data suggests increasing rainfall extremes—both in intensity and decline—possibly due to climate change. This variability can exacerbate challenges such as droughts, floods, and their associated impacts on agriculture, water security, and ecosystems.

***These findings emphasize the need for adaptive water management strategies and climate resilience planning to mitigate the adverse effects of such precipitation variability.***

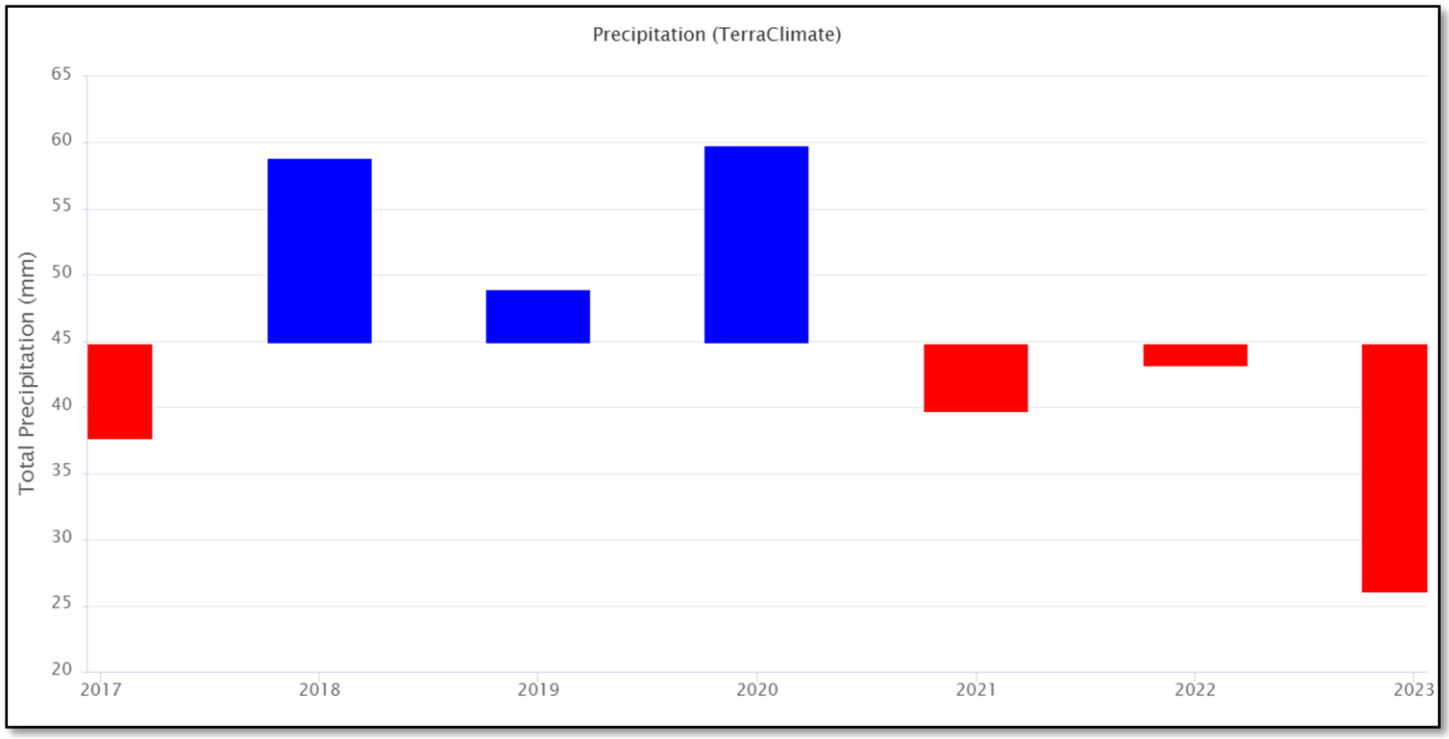


**Fig. 4**: Total precipitation (in **millimeters**) from **2017** to **2023** based on **TerraClimate** data. (Source: **TerraClimate**).

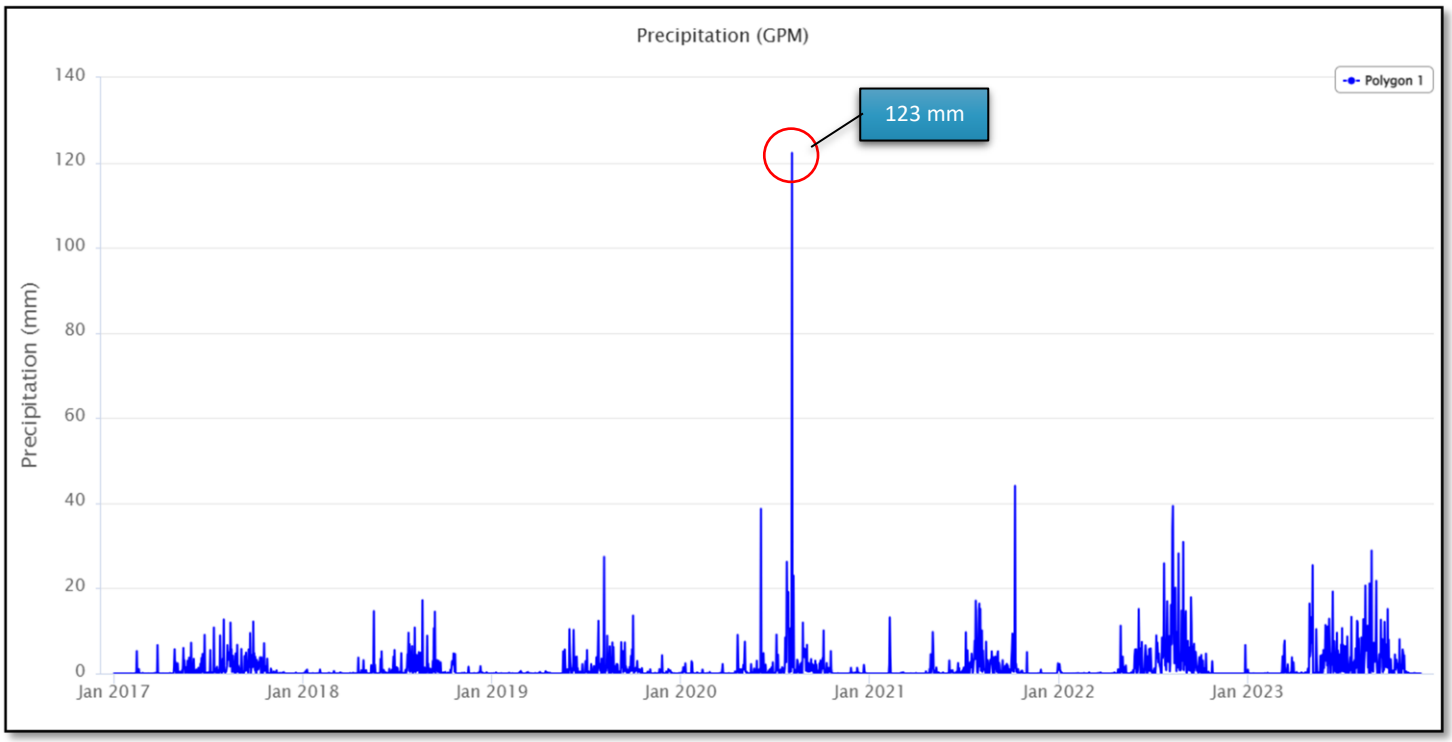


**Fig. 5**: Shows the rainfall trends from January **2017** to December **2023**, measured in millimeters (**mm**). (Source: **GPM**).

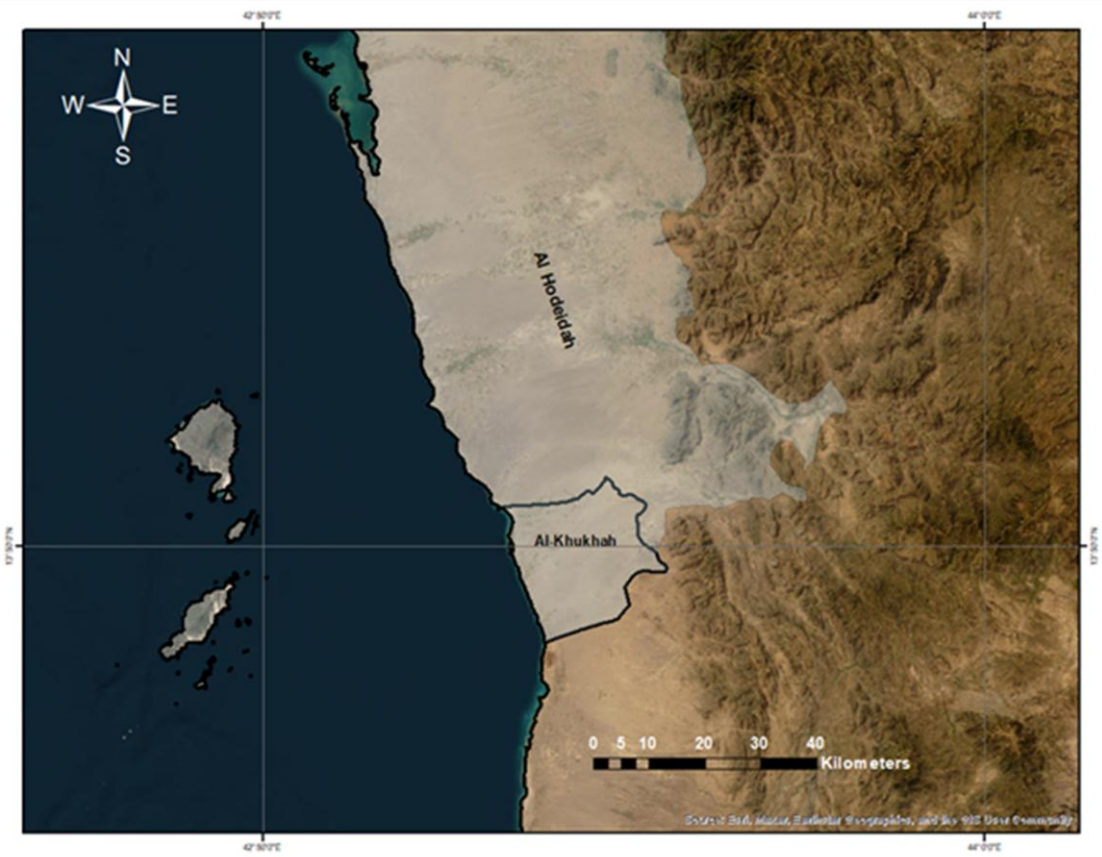


Fig. 6: Depicts the location of Al-Khukhah district. (Source: **the author**).

The raster precipitation map (Figs. 6 and 7-***Upper***) illustrates precipitation levels (in **millimeters**) across Al-Hodeidah and Al-Khukha regions. The color gradient ranges from high precipitation (represented by blue, reaching values up to **860 mm**) to low precipitation (yellow/orange, with values as low as **229 mm**). Figure 7, ***Lower***, depicts a zoomed view of Al-Khukhah **district**, which has a higher rainfall concentration than the northern portions of Al-Hodiedah **governorate**. This location has a significant potential for flooding.

## Map Analysis: Insights and Implications

- **High Precipitation Zones**: The coastal areas, particularly near Al-Hodeidah, show significant precipitation levels, represented by shades of blue. These regions are likely more prone to flooding due to their proximity to the coast and higher rainfall.

- **Low Precipitation Zones**: The inland areas, represented in orange and yellow, experience much lower precipitation. These zones might face issues like drought or water scarcity but are less likely to experience frequent flooding.
- **Implications**: The variation in precipitation suggests that the coastal zones demand more attention regarding flood mitigation strategies and infrastructure development. Conversely, inland areas require sustainable water management practices to address potential water deficits.

The map can serve as a vital tool for regional planning, aiding in the identification of priority areas for climate adaptation measures, disaster risk reduction, and sustainable resource management.

Figure 8, depicts a map of flood risk scores and internally displaced persons (**IDP**) sites in Yemen's Al-Hodeidah's **governorate**, using two-dimensional hydraulic flood hazard modeling. Based on the above-mentioned digital raster maps, flood risk scores and the locations of **internally displaced persons** (**IDP**) map (Fig. 8) revealed the following main findings and impacts:

## Key Observations

1. **Flood Risk Areas**:
    - Regions highlighted in **yellow shades** represent areas with varying flood risk levels, ranging from **low** to **extreme**. The darker shades indicate **higher flood risks**.
    - **Flood-prone regions** are concentrated near low-lying and coastal areas, particularly along river basins and drainage systems.
2. **Internally Displaced Persons (IDP) Sites**:
    - The blue dots mark the locations of **IDP** sites. Many of these sites are situated in areas classified as medium or high flood-risk zones.
    - This placement highlights the vulnerability of displaced populations to flooding, exacerbating their existing humanitarian challenges.

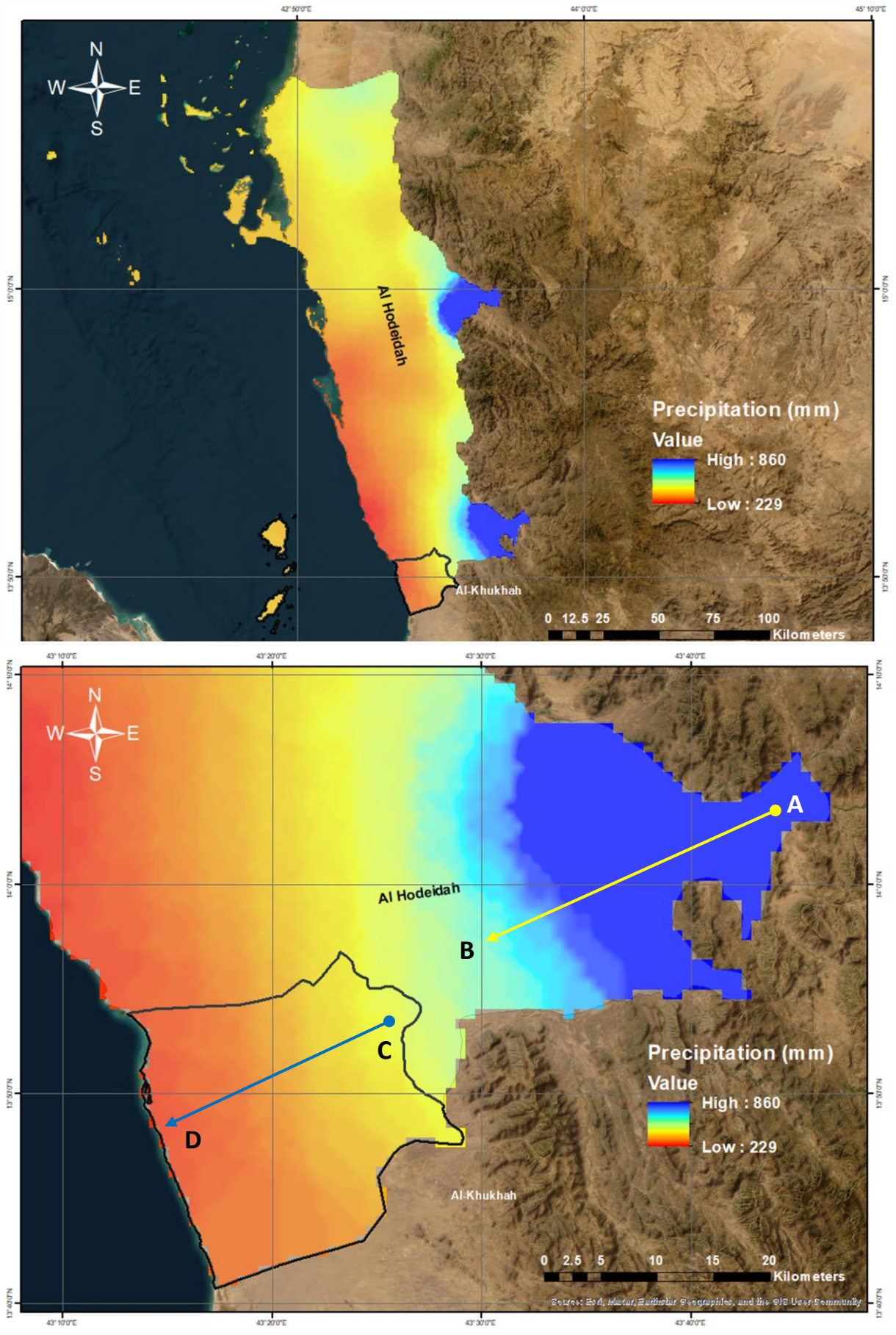


Fig. 7: ***Upper***: Rainfall concentration; ***Lower***: Direction of increasing rainfall. (Source: **the author**).

3. **Geographical Factors**:
    - The topography depicted in the map indicates that elevated areas, represented by dark-gray shading, have less flood risk due to natural drainage.
    - Coastal zones and flat regions are at higher risk due to their proximity to water sources and lack of elevation.
4. **Prioritization for Interventions**:
    - Areas with a combination of high flood risk and **IDP** concentration need urgent attention. These areas require targeted interventions such as flood mitigation measures and relocation strategies.

## Flood Impacts

The map in **Figure 7** depicts flood risk scores and the locations of internally displaced persons (**IDP**) sites in **Yemen's Al-Hodeidah governorate**, using two-dimensional hydraulic flood hazard modeling. Flood-prone regions, represented by yellow shades, vary in risk levels from low to extreme, with darker shades indicating higher risks. These areas are primarily concentrated in low-lying coastal zones and along river basins, while elevated regions, shown in dark-gray shading, are less prone to flooding due to natural drainage. Notably, many **IDP** sites, marked as blue dots, are situated within medium to high flood-risk zones, highlighting the vulnerability of displaced populations to flooding and exacerbating their existing challenges. Flooding in these areas poses significant risks, including displacement, damage to infrastructure such as roads and agricultural lands, and threats to water and sanitation systems, compounding **humanitarian** needs. Additionally, the overlap of high flood-risk zones and **IDP** concentrations underscores the urgency for targeted interventions, such as flood mitigation measures, disaster preparedness, and relocation strategies. Recurring floods also contribute to environmental degradation, including soil erosion and contamination of water sources, further stressing the region's fragile ecosystem. This map emphasizes the need for prioritizing disaster response and resource allocation to protect vulnerable communities.

## Box 1: Flood Map Analysis

The flood map (Fig. 7), created using **satellite image analysis**, is an important tool for prioritizing flood mitigation actions and allocating resources to safeguard vulnerable populations in **Al-Hodeidah governorate**. It provides valuable insights into high-risk zones, enabling targeted interventions to minimize the adverse impacts of flooding on displaced populations and infrastructure. Furthermore, the map can guide policymakers in implementing long-term strategies such as improving drainage systems, reinforcing embankments, and adopting sustainable land-use practices. By integrating this data into disaster risk management plans, stakeholders can enhance resilience and reduce vulnerability, ensuring a safer environment for affected communities while addressing the broader implications of climate change.

Additionally, the flood map serves as a crucial reference for emergency response teams, allowing for more efficient evacuation planning and resource distribution during flood events. It also aids urban planners in designing flood-resistant infrastructure and housing developments, ultimately contributing to sustainable urban expansion. Moreover, continued monitoring and updates to the map can help track changes in flood patterns over time, enabling adaptive strategies that align with evolving environmental conditions.

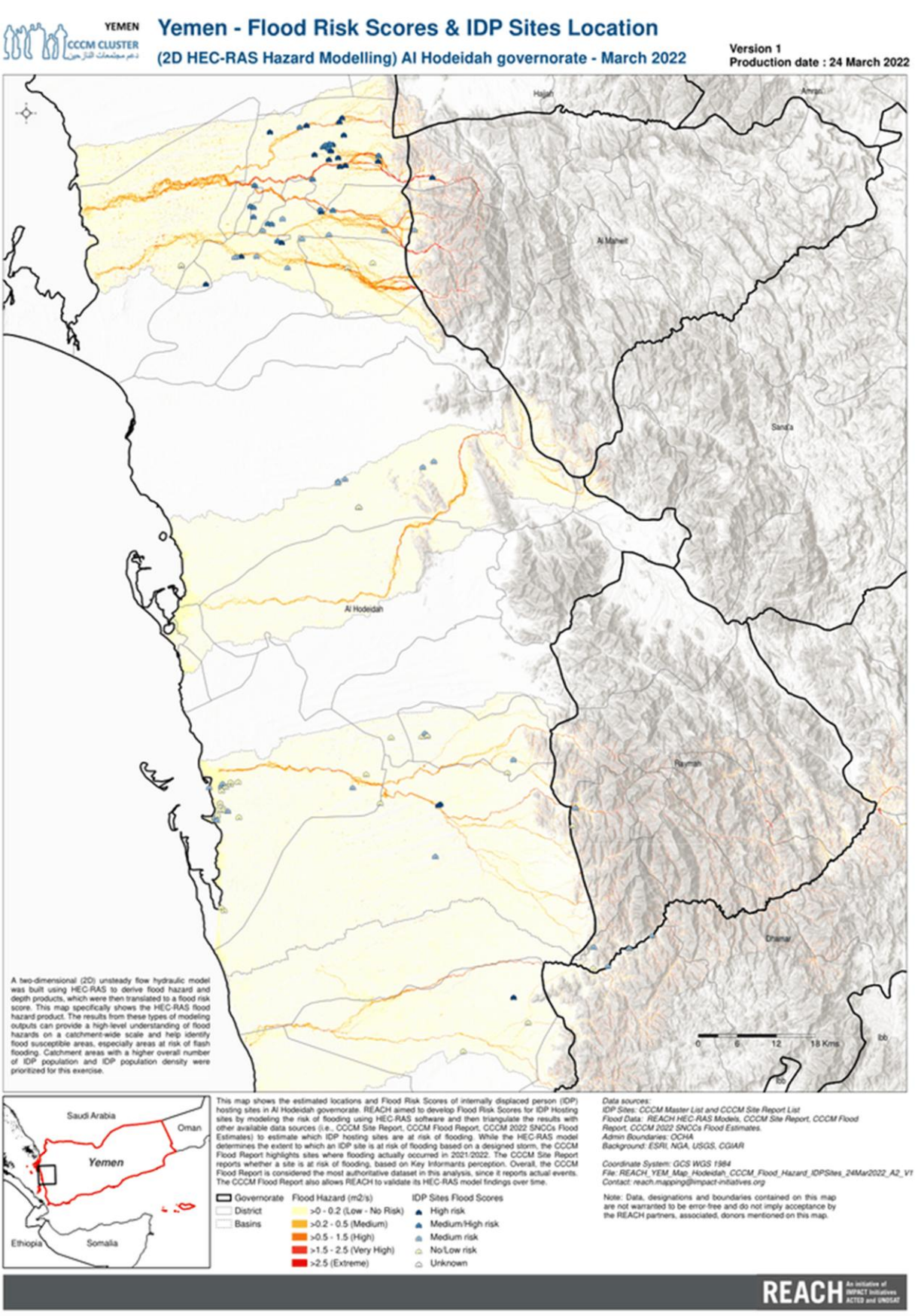


**Fig. 8**: Illustrates the flood zones within **Al-Hodiedah governorate** (Yellow areas). (Source: **REACH**.)

# Taiz Governorate

# II. Climate Change Impacts: Taiz

## II.1. Overview

### Climate Change and Its Impact on Taiz Governorate

**Taiz governorate**, situated in the **southern** highlands of **Yemen**, is one of the most populous regions in the country. It is characterized by a varied topography that includes mountainous terrain, valleys, and coastal areas (**Figs. 9** and **10**). This diversity makes the region particularly vulnerable to the multifaceted impacts of climate change.

### Key Impacts of Climate Change on Taiz

1. **Rising Temperatures**:

   **Taiz** is experiencing increasing temperatures, which exacerbate water scarcity in an already arid environment. The rising heat intensifies evaporation rates, leading to reduced availability of surface and groundwater resources. This is particularly concerning for agricultural activities, which are the backbone of the region's economy.

2. **Erratic Rainfall Patterns**:

   The **governorate** has witnessed significant shifts in rainfall patterns, including irregular precipitation and shorter rainy seasons. These changes contribute to

flash floods during intense rain events and prolonged drought periods, both of which severely impact agriculture, infrastructure, and local livelihoods.

3. **Flood Risks**:

   Climate-induced intense rainfall events have led to an increase in flash floods, particularly in urban areas with inadequate drainage systems. These floods damage critical infrastructure, displace communities, and spread waterborne diseases, posing a major public health risk.

4. **Drought Conditions**:

   Prolonged periods of drought, attributed to **climate change**, are becoming more frequent in **Taiz**. This has resulted in crop failures, reduced food security, and a decline in livestock productivity. The water crisis is further worsened as groundwater sources become increasingly depleted.

5. **Ecosystem Degradation**:

   **Climate change** is altering natural ecosystems in **Taiz**, leading to the loss of biodiversity. Forested areas in the governorate are shrinking due to deforestation and climate stress, which reduces their role in regulating the local climate and supporting agriculture.

6. **Humanitarian Challenges**:

   The combined effects of **climate change** and conflict in **Yemen** exacerbate vulnerabilities in **Taiz**. Displacement due to both conflict and climate-induced disasters has increased, placing additional pressure on limited resources. Internally displaced persons (**IDPs**) often face heightened exposure to climate risks, including floods and heatwaves.

## Adaptation and Mitigation Measures

To address the growing impacts of **climate change**, **Taiz** requires targeted interventions:

- **Water Resource Management**: Investments in water harvesting, storage, and efficient irrigation systems can help mitigate water scarcity.
- **Climate-Resilient Agriculture**: Promoting drought-resistant crops and sustainable farming practices can enhance food security.
- **Disaster Preparedness**: Strengthening **early warning systems** and infrastructure to cope with floods and droughts is critical.
- **Reforestation and Ecosystem Restoration**: Protecting and restoring forests and ecosystems can help reduce the adverse effects of **climate change**.

Finally, **Taiz governorate** has considerable climate-related issues, particularly in the areas of water security, agriculture, and catastrophe risk. Addressing these concerns demands a comprehensive and inclusive approach that integrates local, national, and international efforts to strengthen resilience and secure the region's long-term prosperity.

**Taiz governorate** in **Yemen** has experienced several significant floods in recent years, notably in **2024**. Here are some of the major incidents:

- **August 2, 2024**: Severe flooding in the **Maqbanah district** of **Taiz** city resulted in **15** deaths and displaced approximately **10,000** people. The floods buried at least **80** wells, destroyed crops, and caused significant damage to houses and infrastructure.
- **April 2024**: Heavy seasonal rainfall from mid-March to late **April** led to flooding in many of **Yemen's governorates**, including **Taiz**. This event affected more than **18,000** families.
- **August 2024**: Torrential rains and widespread flooding damaged homes and shelters of host communities and internally displaced persons (**IDPs**) in **Taiz**. Approximately **5,321** families were affected during this period.

These incidents highlight the vulnerability of **Taiz** to flooding, particularly during the rainy seasons. In addition, **Taiz** has experienced multiple floods in the past due to

seasonal rains, poor infrastructure, and the region's mountainous terrain. Here are a few historical instances:

**2010:** ***Event***: Yemen, including Taiz, was struck by severe flooding caused by unusually heavy rains. Many areas experienced flash floods that led to fatalities, infrastructure damage, and the displacement of people[24].

**2009:** ***Event***: Torrential rains caused rivers to overflow, leading to extensive flooding in Taiz and surrounding areas. Roads were damaged, and numerous families were displaced[25].

**2008:** ***Event***: Heavy rainfall in the region caused significant flooding in Taiz, damaging homes, infrastructure, and agricultural lands. Many rural communities were affected, and displacement was widespread[26].

**1997-1998:** ***Event***: The **El Niño** phenomenon brought torrential rains to Yemen, leading to severe flooding. This event was among the most damaging, with infrastructure, homes, and agricultural land destroyed[27].

## II.2. Historical Data Analysis

The map in Fig. 11 depicts spatial precipitation distribution across a specific area, with precipitation values presented in millimeters and classified into distinct ranges using a color gradient. The analysis and relevant remarks are as follows:

### Data Analysis

1. **Precipitation Gradient**:

   The precipitation gradient across the area shows a clear west-to-east pattern, with the western part (red zone) receiving the lowest precipitation values, ranging from **211** to **599 mm**. Moving eastward, precipitation increases

[24] Yemen Floods (2010) - Yemen Humanitarian Response Plan." United Nations Office for the Coordination of Humanitarian Affairs (OCHA).
[25] Yemen 2009: Flash Floods Impact Report." United Nations Development Program (UNDP).
[26] Floods and Rainy Season Impact in Yemen." International Federation of Red Cross and Red Crescent Societies (IFRC).
[27] El Niño and its Impact on Yemen's Weather and Flooding." The National Center of Meteorology, Yemen.

progressively, transitioning through orange, yellow, green, and blue zones, indicating a gradual rise in rainfall. The easternmost region (deep blue zone) experiences the highest precipitation levels highlighting a significant spatial variation in rainfall distribution.

2. **Geographical Influence:**

   The sharp precipitation gradient implies that topographical or climatic conditions play an important influence in determining rainfall distribution. Coastal areas in the west may receive less precipitation due to rain-shadow effects or proximity to arid regions, whereas eastern areas with higher precipitation are more likely to coincide with elevated terrains or regions affected by orographic rainfall, in which moist air is forced to rise and cool, resulting in increased rainfall.

3. **Area of Concern**:

   The core orange-to-yellow zones show moderate precipitation (**986-2,149 mm**). These areas could serve as a transitional buffer between desert and rainy zones.

4. **Variability in Precipitation**:

   The map (**Fig. 11**) shows significant regional heterogeneity, indicating different microclimates or weather patterns in the targeted area.

## Comments and Implications

Effective management and planning techniques must account for the regional diversity in precipitation across the region. High-precipitation areas (blue zones) have a greater potential for groundwater recharge and surface water harvesting, whereas arid western zones have water scarcity concerns, needing effective water resource management. In terms of agriculture, locations with moderate-to-high precipitation (green to blue zones) are good for rain-fed farming, whereas arid areas may require irrigation. **Climate resilience** is crucial, as the arid **western zones** (red and orange) are more susceptible to drought, necessitating sustainable development techniques.

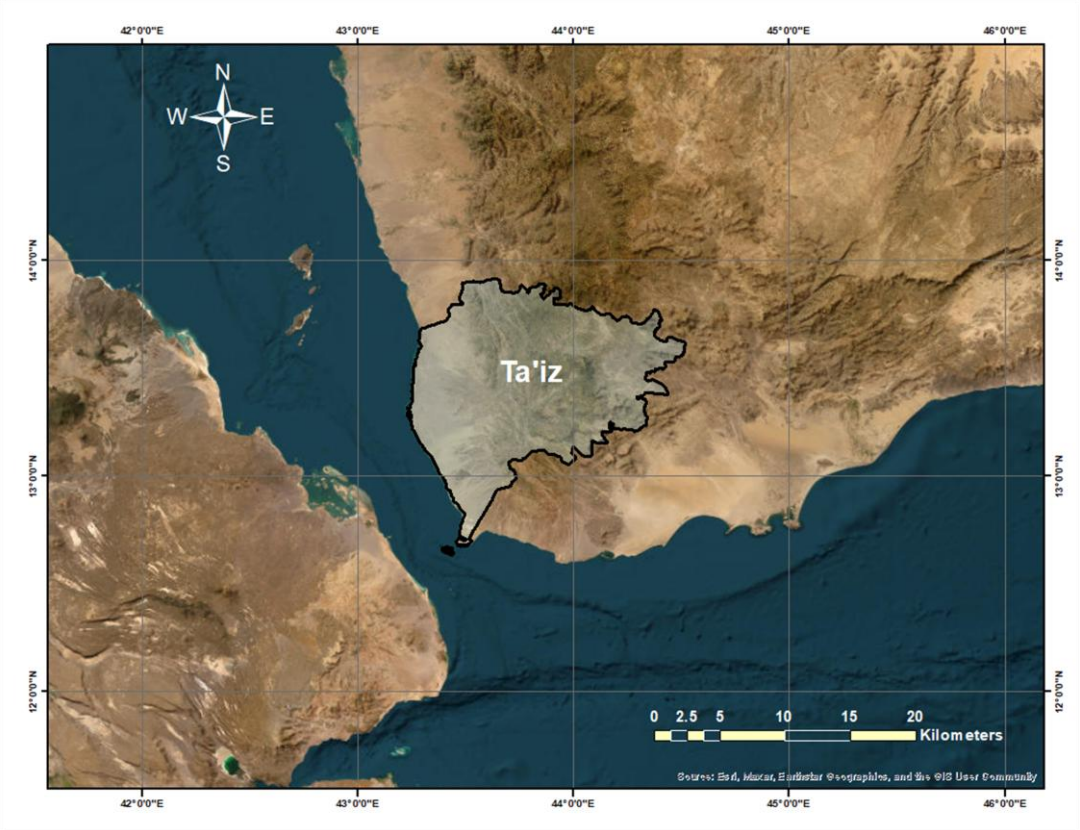


**Fig. 9**: Shows the geographic location of **Taiz governorate**. (Source**: the author**).

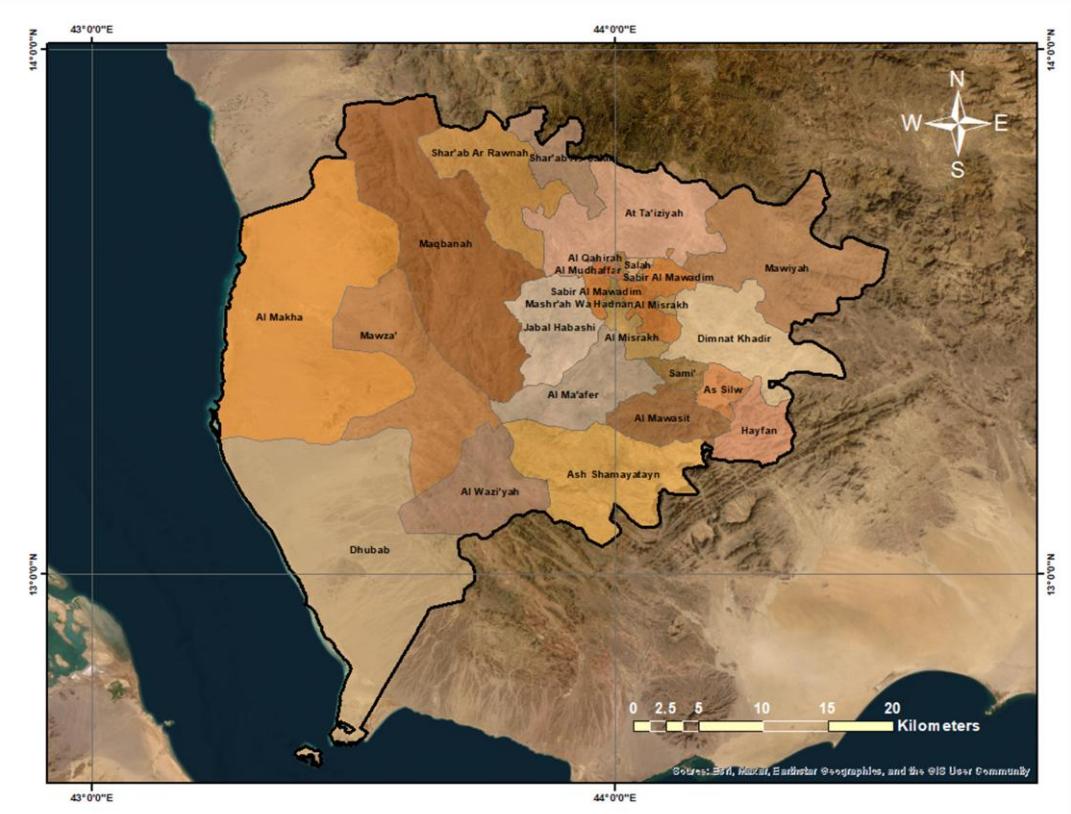


**Fig. 10**: Depicts the Districts of **Taiz governorate** (Source**: the author**).

Furthermore, while the eastern high-precipitation areas might support rich biodiversity, they may also be vulnerable to landslides and soil erosion caused by heavy rains. Urban and infrastructure planning should account for these differences, incorporating efficient water delivery systems in low-precipitation areas and focusing on flood control in high-precipitation areas.

To present a comprehensive study linking precipitation patterns on the map with land use, vegetation patterns, and disaster risk zones, the following is an enlarged analysis with implications:

## Comprehensive Analysis

### 1. Precipitation and Land Use

Land-use planning in the region must account for the distinct precipitation zones and their respective characteristics. Arid zones (red to orange), with low precipitation levels of **211–986 mm**, are primarily suited for sparse settlements or urban areas reliant on imported water or advanced water management systems, limited agriculture with drought-resistant crops or livestock grazing, and solar energy projects due to clear skies. Water scarcity remains a key constraint for development in these areas. Moderate precipitation zones (yellow to green), receiving higher than **986 mm** of rainfall[28], are ideal for mixed agriculture, including rain-fed crops and horticulture, settlements with moderate water resource availability, and managed forest plantations or agroforestry projects. These regions serve as an ecological transition buffer between arid and wetter areas. High precipitation zones (blue), support dense forests, biodiversity-rich ecosystems, intensive agriculture with water-demanding crops like rice or tea, and hydropower generation or water-intensive industries. However, these areas require careful land-use planning to integrate soil conservation measures and mitigate erosion risks.

### 2. Precipitation and Disaster Risk Zones

[28] **PERSIANN-CCS** grid rainfall data shows high values when compared to **TerraClimate** data. The **RESIANN-CCS** grid data was used to display rainfall concentrations in the **Taiz** region.

Precipitation zones in the region face distinct challenges and risks associated with their rainfall patterns. Low precipitation zones (red to orange) are at high risk of drought and desertification due to prolonged dry spells, along with dust storms and soil degradation, making effective water management strategies, such as desalination plants or reservoirs, critical. Moderate precipitation zones (yellow to green) are vulnerable to moderate droughts during below-average rainfall years and flash floods during intense rainfall due to limited water infiltration capacity, necessitating a balanced approach to water harvesting and soil conservation. High precipitation zones (blue) face significant susceptibility to disasters, including floods caused by excessive surface runoff, landslides in sloped terrains, and soil erosion from intense rainfall. Implementing disaster risk reduction strategies such as afforestation, terracing, and floodplain management is essential to mitigate these risks.

## Implications for Study Area

1. **Integrated Water Management**:
    - Establish region-specific water management systems, including rainwater harvesting in arid zones and flood control measures in high-rainfall areas.
2. **Disaster Preparedness**:
    - Implement **early warning systems** for droughts and floods.
    - Develop community-based disaster resilience programs, particularly in blue zones prone to landslides and floods.
3. **Climate Adaptation Strategies**:
    - Link precipitation patterns to long-term **climate change** projections.
    - Develop adaptive plans for communities relying on natural resources.

The graph in **Fig. 13** depicts precipitation trends (in **mm**) for a given polygon from January **2017** to January **2024**, as calculated using **TerraClimate** data. The analysis and its potential influence on the research region are presented below:

## Analysis of Precipitation Patterns

1. **Seasonal Variations**

The data reveals recurring peaks and troughs, showcasing distinct seasonal precipitation patterns. High rainfall is concentrated during specific months, likely corresponding to monsoon or wet seasons, while dry periods dominate the remaining months.

2. **Inter-annual Variability**

   The amplitude of precipitation varies significantly across years. For example:

   - **2018** and **2021** experienced extreme peaks, with precipitation exceeding **60 mm**.
   - In contrast, **2020** and **2022** displayed relatively lower and more consistent precipitation levels.

3. **Dry Periods**

   **Several** prolonged dry spells are evident in the data, such as during late **2019**, **2022**, and early **2023**. These periods of notably low precipitation highlight potential drought risks.

4. **Trends and Fluctuations**

   There are no clear linear trends indicating a long-term increase or decrease in precipitation. However, the observed high inter-annual variability suggests the possibility of shifting climatic conditions.

## Insights and Implications of Precipitation Patterns

Extreme precipitation peaks could lead to localized flooding events, posing risks to infrastructure, agriculture, and human settlements. Conversely, prolonged dry periods, such as those observed in **2019** and **2022**, highlight vulnerabilities to drought, potentially stressing water resources, reducing agricultural productivity, and impacting local biodiversity. The significant variability in precipitation underscores the importance of adaptive water resource management strategies, enabling effective storage and distribution to mitigate risks during dry spells and capitalize on surplus water during wetter periods. Additionally, the observed fluctuations may serve as indicators of climate change's impact on the hydrological cycle, warranting further studies to understand long-term changes and their implications.

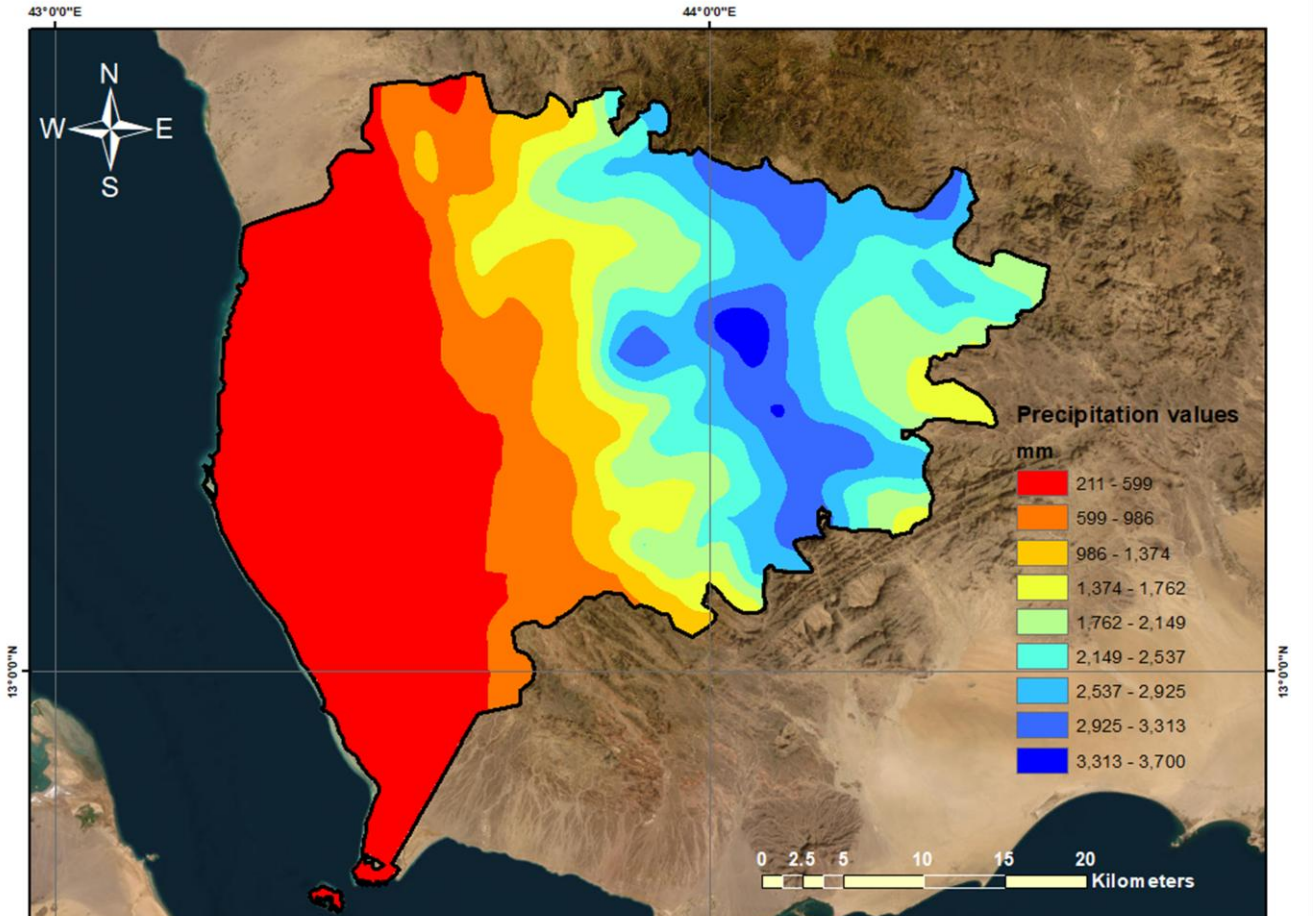


**Fig. 11**: Depicts the spatial rainfall distribution within **Taiz governorate** (Source**: the author**).

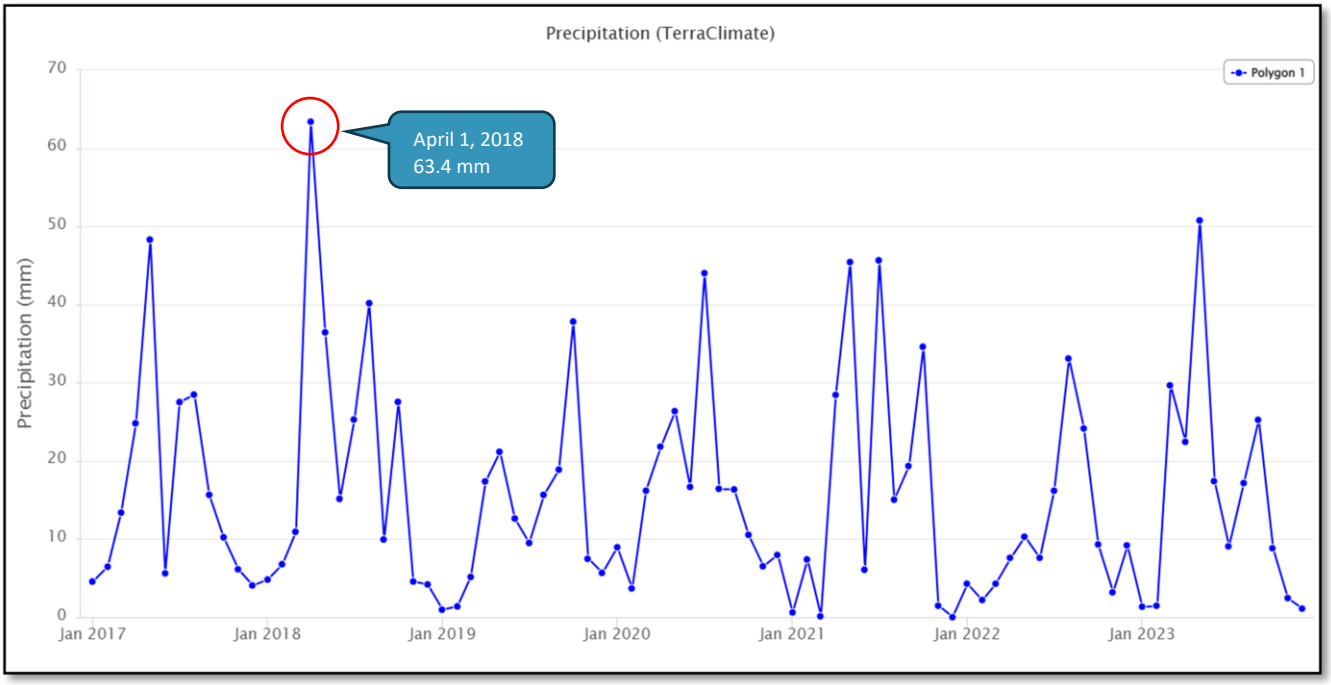


**Fig. 12**: Depicts the historical rainfall data of **Taiz Governorate** between **2017-2023** ( **Data Source**: **TerraClimate**).

## Flood Impacts on the Area

"Flood Impacts on the Area" investigates the consequences of flooding on local populations, infrastructure, and the environment, emphasizing the problems brought by frequent and severe floods. This evaluation sheds light on the damage caused by floods and the implications for livelihoods, public health, and economic stability as depicted in **Figure 13**.

**1. Humanitarian Impacts**

The **humanitarian** consequences of flooding are especially severe for internally displaced people (**IDPs**), as many **IDP** settlements are located in medium to high flood hazard zones, putting vulnerable populations at risk of displacement, injury, or death. **IDPs'** temporary shelters are often vulnerable to floods, increasing their risk of contracting waterborne infections, losing their housing, and experiencing livelihood disruptions. Flooding can also ruin roads and infrastructure, separating **IDP** settlements from critical services like healthcare, food supply, and education. This disturbance impedes the delivery of **humanitarian** aid, worsening already terrible living circumstances (**Fig. 13**).

**2. Infrastructure and Settlement Impacts**

Flooding endangers both urban and rural areas, with urban centers like **Taiz City** sustaining damage to homes, businesses, and public infrastructure such as highways and water delivery systems. Flooding in rural regions can destroy basic facilities and livelihoods based on agriculture, exacerbating vulnerability. Major transportation networks that run through high-hazard zones may become impassable, interrupting movement and trade, while bridges and culverts in flood-prone areas face increased danger of collapse or catastrophic damage.

**3. Agricultural Impacts**

Flooding in rural areas can cause crop destruction, loss of cultivated land, and soil erosion, all of which have a substantial influence on food security and agricultural output. Prolonged waterlogging in medium and high flood risk zones worsens the

situation by lowering soil fertility and impeding re-cultivation attempts, making recovery difficult for impacted people.

**4. Environmental Impacts**

Flooding can cause severe environmental impacts, including erosion and land degradation, as high-intensity floods strip away topsoil, particularly in areas with steep slopes or inadequate vegetation cover, resulting in long-term damage to the land. Additionally, flooding often contaminates water sources with sewage, chemicals, and debris, posing significant health risks to humans and wildlife. The destruction of habitats in flood-prone areas further contributes to biodiversity loss, displacing both terrestrial and aquatic species and disrupting ecosystems.

**5. Disaster Risk Amplification**

Flooding in medium and high flood hazard zones perpetuates a cycle of displacement and poverty for impacted communities, compounding their vulnerabilities over time. **Climate change** exacerbates this risk, as flood frequency and severity are predicted to rise, emphasizing the critical need for long-term risk reduction initiatives to reduce these consequences.

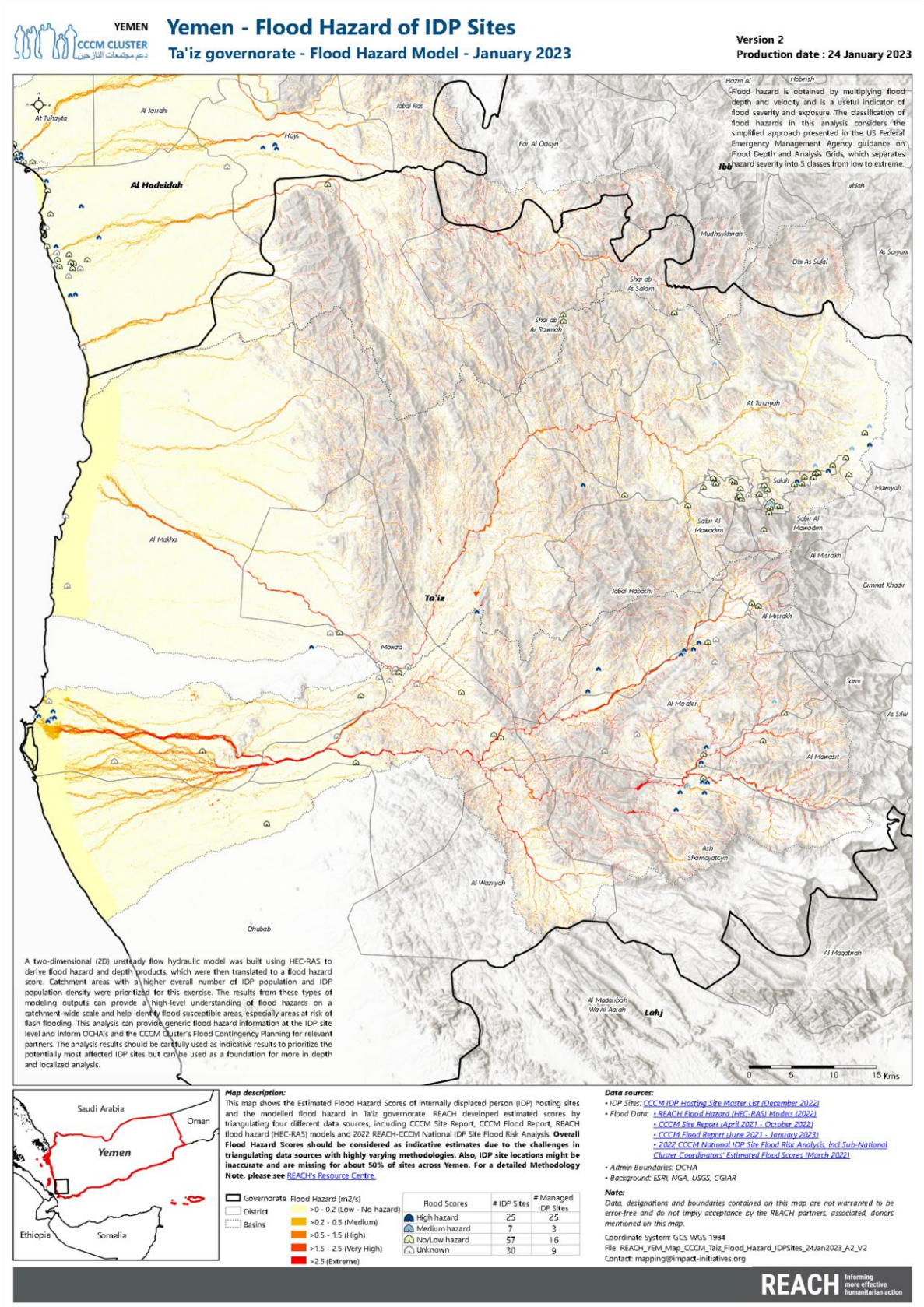


**Fig. 13**: Depicts the flooded areas of some parts of **Taiz** **Governorate** (**Source: REACH**).

# Aden Governorate

## III. Climate Change Impacts: Aden

### III.1. Overview

**Aden**, a port city in **Yemen**, is strategically located along the north coast of the **Gulf of Aden**, situated on a peninsula that encloses the eastern side of **Al-Tawāhī Harbour**. This geographical positioning has historically made **Aden** a vital maritime hub[29] (**Fig. 14**). Despite its arid climate, **Aden** is not immune to the impacts of seasonal heavy rains. In recent years, torrential downpours have led to significant flooding, causing widespread damage to infrastructure and homes. For instance, in **mid-April 2020**, exceptionally heavy rains resulted in deadly floods across **Yemen**, including **Aden**, exacerbating the challenges faced by the war-stricken country[30] (**Figs. 15 - 18**).

The city's coastal location and topography contribute to its vulnerability to such natural disasters. Floodwaters can quickly inundate low-lying areas, leading to displacement and increasing the spread of waterborne diseases. The combination of conflict, inadequate infrastructure, and extreme weather events underscores the need for comprehensive disaster preparedness and resilient infrastructure development in **Aden**.

In **2020**, **Aden** experienced severe flooding that caused significant damage and loss of life. These floods swept through all regions, washing away countless cars and trucks and causing extensive damage to homes. The source reported that at least five people lost their lives as the flooding devastated numerous neighborhoods, destroying

[29] https://www.britannica.com/place/Aden?utm_source=chatgpt.com
[30] https://www.icrc.org/en/document/yemen-torrential-floods-wreak-havoc-war-stricken-country?utm_source=chatgpt.com

hundreds of homes and shops and leading to significant material losses. The following images depict the severe rain and the impact of these floods wreaking havoc across the city (**Figs. 15** - **18**).

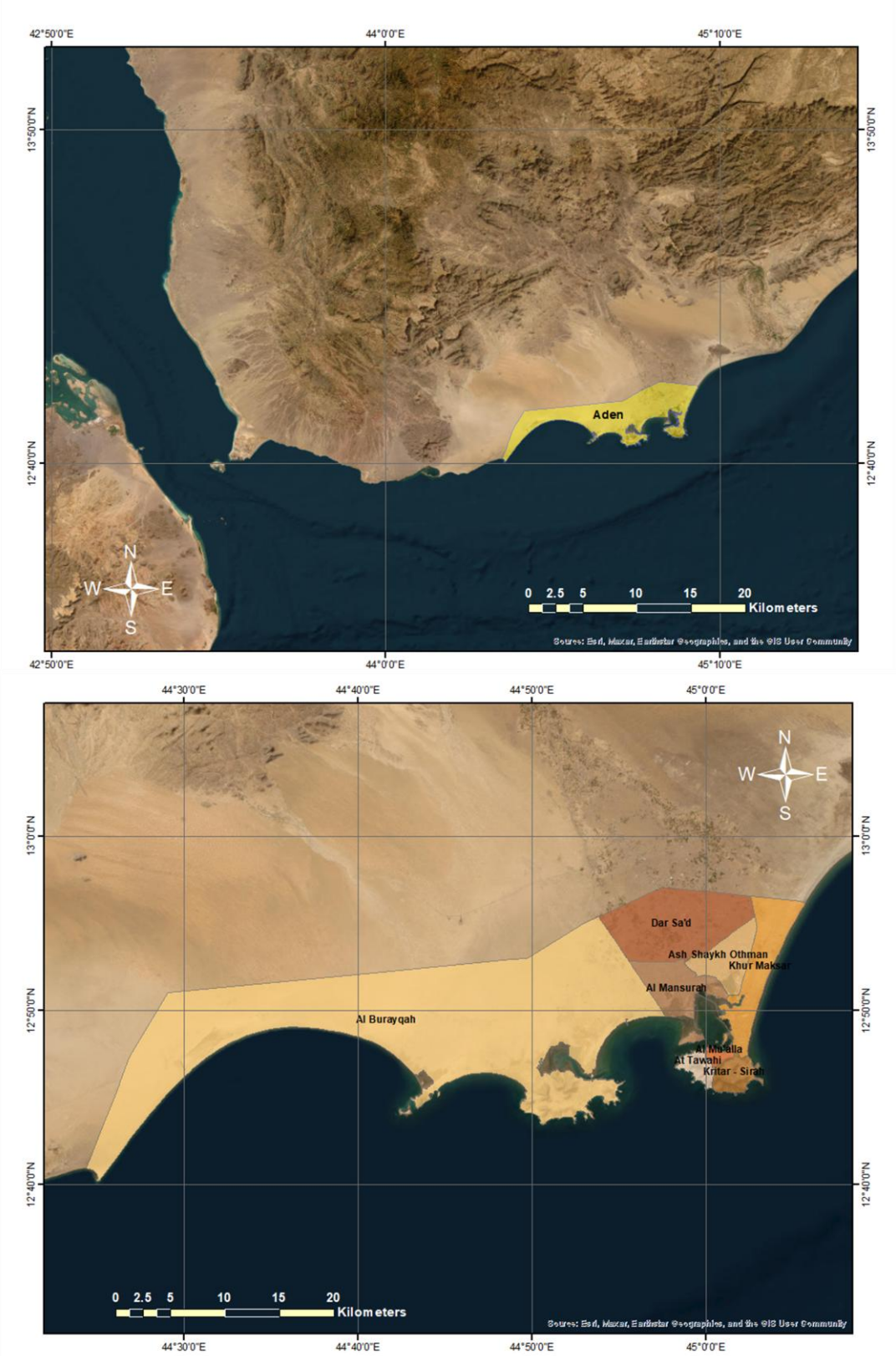


**Fig. 14**: Both maps depict the geographic location and the districts in **Aden** (Source**: the author**).

**Fig. 15**: Heavy rains which have caused massive torrential floods in **Aden** (**2020**). (Source: **ypagency**). https://en.ypagency.net/167427

**Fig. 16**: People stand on automobiles that were destroyed by the floods – **Aden** (**2020**). (Source: **ICRC**). https://www.icrc.org/en/document/yemen-torrential-floods-wreak-havoc-war-stricken-country?utm_source=chatgpt.com

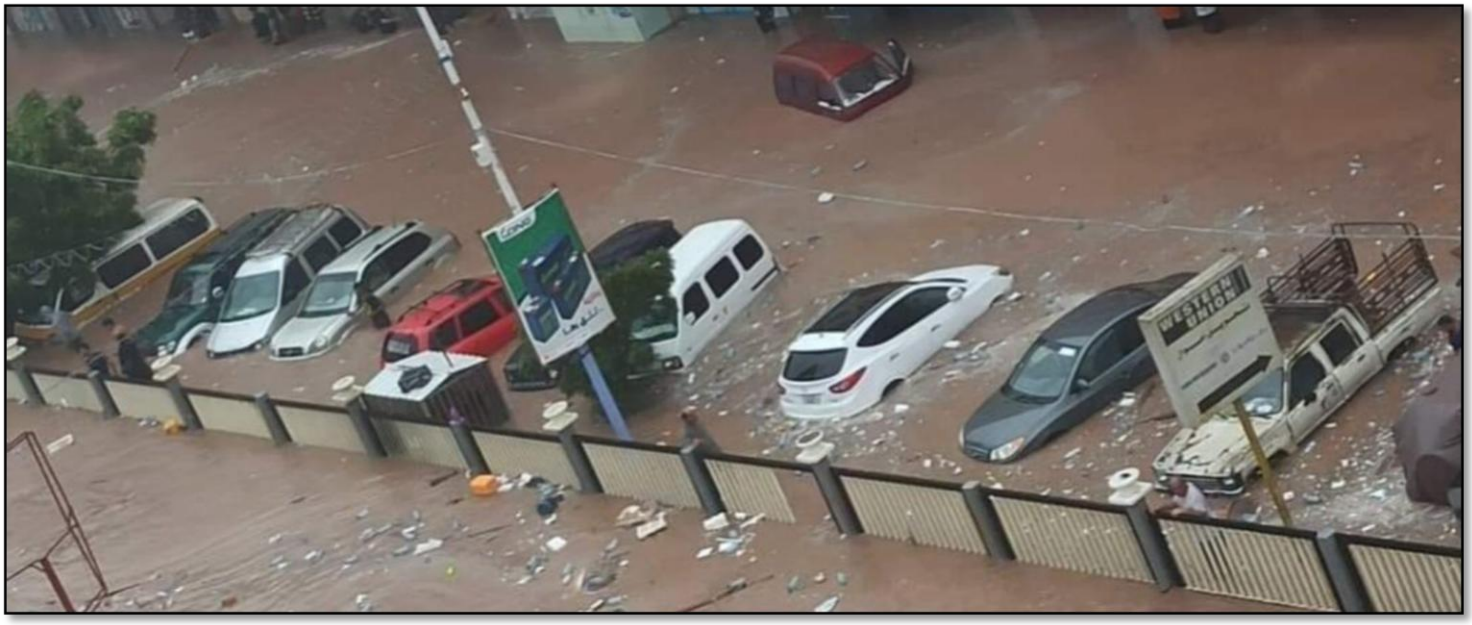

**Fig. 17**: Flood disaster destroyed the properties in **2020** – **Aden**. (Source: **middleeasteye, 2020**)
https://www.middleeasteye.net/news/yemen-aden-disaster-area-flash-floods.

**Fig. 18**: A devastating flash floods caused by up to **125 mm** (**5 inches**) of rain in just **24 hours** in **Aden**. (Source: **watchers**, **2020**).
https://watchers.news/2020/04/22/aden-declared-a-disaster-area-after-catastrophic-flooding-kills-10-yemen/, 2020

# III.2. Climate Data Analysis

## Numeric Precipitation Data Analysis

The chart of Figure 19 depicts daily precipitation data for the Aden region from **June 2017** to **December 2023**, measured in millimeters (**mm**) using **GPM** (**Global Precipitation Measurement**) data. The primary findings are shown below.

1. **Highly Variable Rainfall**:

   The precipitation data reveals substantial variability, characterized by numerous days with little to no rainfall, punctuated by sharp spikes indicating extreme rainfall events. This pattern is typical of arid and semi-arid regions like Aden, where rainfall is sporadic and often linked to specific weather systems.

2. **Extreme Rainfall Events:**

   Significant spikes in rainfall, particularly in **2019**, **2020**, and **2023**, with daily precipitation exceeding **100-175 mm**, likely correspond to severe storms or extreme weather events. These extreme events are often associated with flash floods, a persistent issue in Aden due to its low-lying geography and inadequate drainage infrastructure.

3. **Seasonality:**

   Rainfall in Aden shows no consistent seasonal pattern but is concentrated in brief, intense events rather than being evenly distributed throughout the year. This aligns with Aden's climate, which is influenced by tropical and subtropical weather systems that occasionally bring intense rain.

4. **Trends Over Time:**

   There are no clear signs of a gradual increase or decrease in annual rainfall totals, but the occurrence of extreme events suggests potential implications of climate change, which can amplify the intensity and frequency of such events.

## Potential Impacts:

- **Flood Risk**: The sharp peaks, particularly in **2019** and **2020**, suggest a high likelihood of floods during these extreme rainfall events.
- **Urban Planning Challenges**: **Aden's** infrastructure must account for these extreme events to reduce damage and improve resilience.

**Note**: This preliminary historical climate data shows the prevailing rainfall conditions from **2017** to **2023**. This aids in the creation of an image of the predominant rainfall circumstances during these years, as well as understanding their impact on flood development and forecasting.

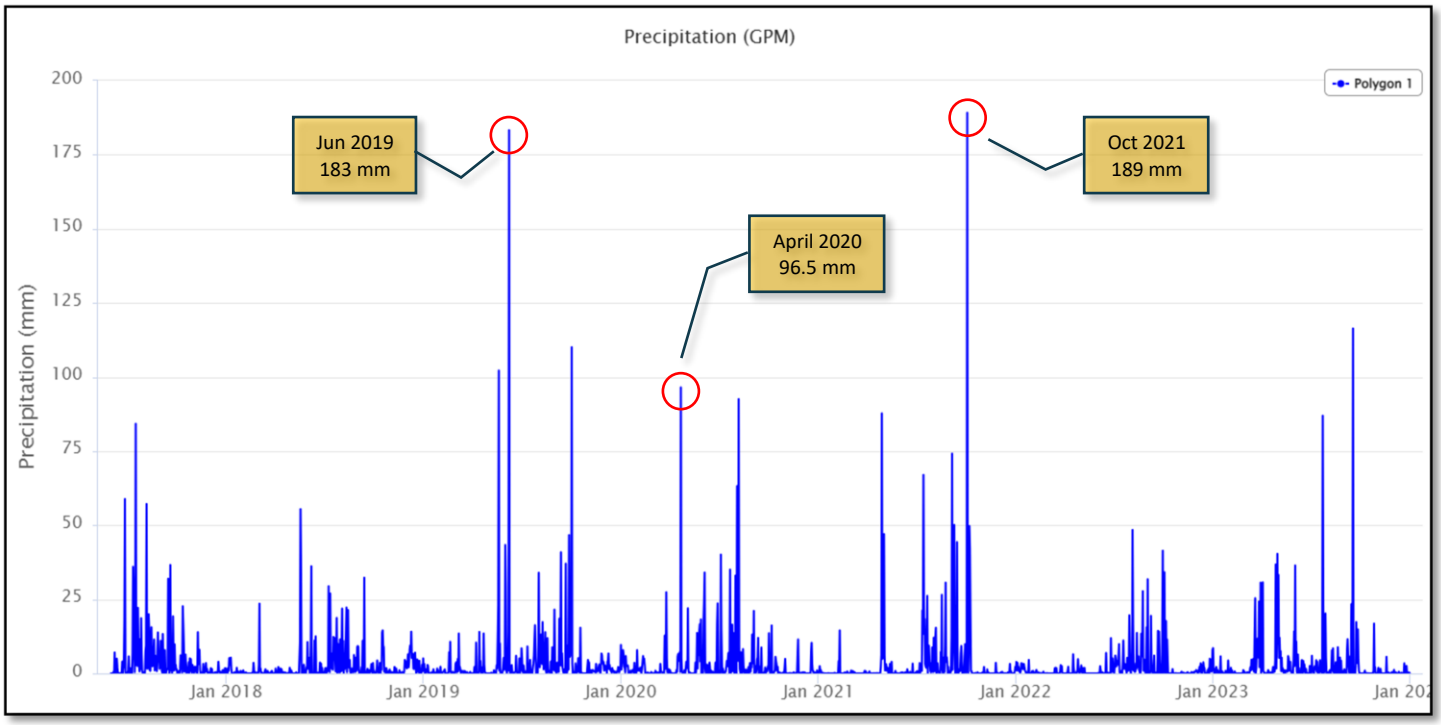


Fig. 19: The rainfall chart highlights the extreme variability of precipitation in Aden from **2017** to **2023**.

## Benefits of Using Raster Images for Rainfall Analysis

**Raster images** provide a powerful tool for visualizing and analyzing spatial patterns of rainfall distribution over large areas. By representing data in a grid format, they allow for precise quantification of rainfall values at specific locations and the identification of gradients or hotspots. This format is particularly useful for:

1. **Spatial Analysis**: Enables detailed examination of rainfall variability across different regions, helping to identify areas of high and low precipitation.
2. **Data Integration**: Easily integrates with **Geographic Information Systems (GIS)** for combining rainfall data with other spatial datasets, such as population density or infrastructure locations.
3. **Decision Support**: Supports evidence-based planning and decision-making for flood risk management, water resource allocation, and climate adaptation strategies.
4. **Trend Analysis**: Facilitates tracking changes in rainfall patterns over time, essential for understanding the impacts of climate change and planning for future scenarios.

This type of visualization is extremely useful for making informed, location-specific decisions to reduce risks and better manage resources.

## Raster Image Precipitation Data Analysis

### Findings:

1. **Spatial Distribution of Rainfall**:

   The image of **Figure 20** depicts yearly rainfall levels in **Aden** from **2017** to **2023**, demonstrating a distinct spatial distribution. Rainfall is concentrated along the coast, with values ranging from **192-245 mm per year** (blue and cyan), whereas inland areas receive substantially less rainfall, **124-164 mm per year** (red and orange). As one proceeds further inland, a clear gradient of decreasing rainfall emerges.

2. **High-Risk Zones**:

   Coastal areas with higher rainfall are more prone to flash flooding, especially where urban centers and infrastructure intersect with these high-precipitation zones, while inland areas with lower rainfall face challenges related to water scarcity, including drought and limited water resources for agriculture and livelihoods.

3. **Vulnerability to Extreme Events**:

   The difference in rainfall across the region implies a vulnerability to extreme rainfall events in high-rainfall zones, which can enhance flooding hazards in urban and low-lying coastal areas.

## Suggestions:

1. **Flood Mitigation**:

   To effectively prevent flash floods in high-rainfall coastal areas, it is critical to improve drainage infrastructure and develop **Early Warning Systems** (**EWS**) customized to specific high-risk zones. Upgrading drainage systems to handle extreme rainfall improves water management and reduces the likelihood of flooding, whereas **EWS** based on **real-time rainfall** patterns can provide timely alerts to authorities and communities, allowing for proactive responses to potential flood risks. This comprehensive method helps to limit flood damage and protect sensitive locations.

2. **Integrated Water Resource Management**:

   To address water scarcity and balance regional water availability, areas with higher rainfall can be utilized for rainwater harvesting, collecting and storing excess water. This harvested water can then be distributed to areas with lower rainfall through well-designed storage and distribution systems, ensuring a more equitable and sustainable water supply across regions.

3. **Urban Planning**:

   To mitigate flood risks along the coast, it is essential to restrict construction in high-risk flood-prone areas while simultaneously introducing green infrastructure, such as permeable pavements and urban green spaces. These measures will not only reduce surface runoff but also protect vulnerable areas from flooding, promoting a more sustainable and resilient urban environment.

4. **Drought Resilience**:

To address limited water availability in inland regions, water conservation measures such as drip irrigation should be supported, while exploring sustainable solutions like desalination or groundwater recharge to ensure reliable water access in arid zones. This combined approach helps optimize water use and ensures long-term water security in areas facing water scarcity.

5. **Data-Driven Decisions**:

To effectively manage flood and drought risks, sophisticated hydrological modeling is required to predict flood hazards and inform zoning rules, as well as constant monitoring of precipitation trends to adjust strategies for management in real time. This combination approach enables informed decision-making and proactive steps to mitigate the impacts of both flooding and drought.

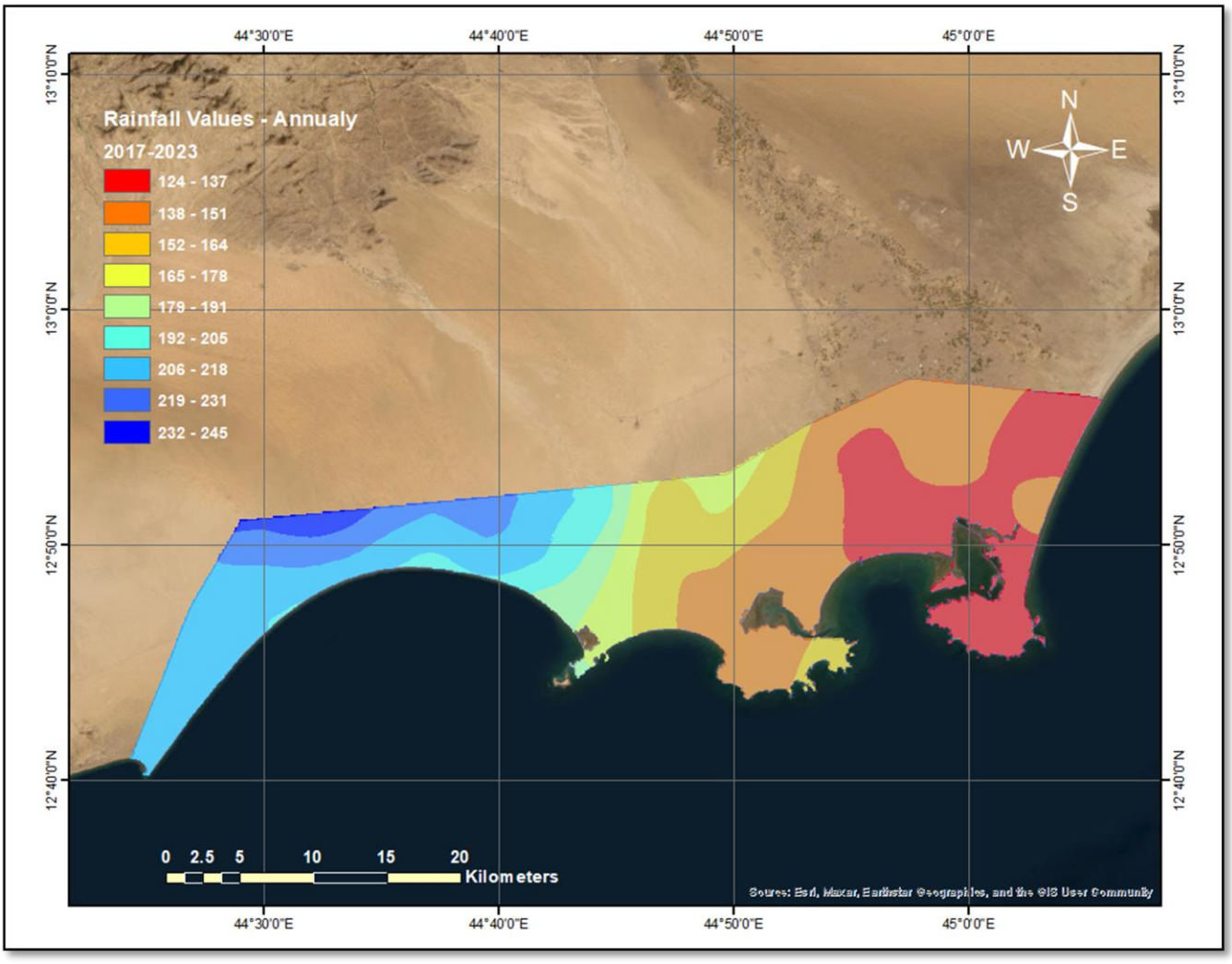


**Fig. 20**: The map depicts the rainfall distribution within **Aden Governorate (**Source**: the author**).

# Hadramout Governorate

# IV. Climate Change Impacts: Hadramout

## IV.1. Overview

### Geography of Hadramout Governorate

**Hadramout** is the largest governorate in **Yemen**, located in the eastern part of the country. It stretches from the coast of the **Arabian Sea** to the vast deserts in the north, including parts of the **Rub' al Khali** (**Empty Quarter**), (**Figure 21**). The governorate is characterized by a diverse landscape, including mountains, valleys, and coastal plains. The **Wadi Hadramout**, a large valley, runs through the region, making it an important agricultural and cultural area. The climate is arid, with hot temperatures and minimal rainfall[31].

### Al-Mukalla City

**Al-Mukalla** is the **capital city** of **Hadramout** **governorate** and a major port on the **Arabian Sea**. Located on the coast, it serves as an important economic hub due to its strategic location for trade and fishing. **Al-Mukalla** has a rich history, with historical sites and traditional architecture, reflecting its cultural heritage. The city has a mix of modern and traditional infrastructure and is a key center for commerce, with a focus on maritime activities, oil exports, and agriculture[32] (**Figs. 22** & **23**).

[31] https://www.preventionweb.net/publication/damage-losses-and-needs-assessment-october-2008-tropical-storm-and-floods-hadramout-and?utm_source=chatgpt.com

[32] https://www.britannica.com/place/Al-Mukalla?utm_source=chatgpt.com

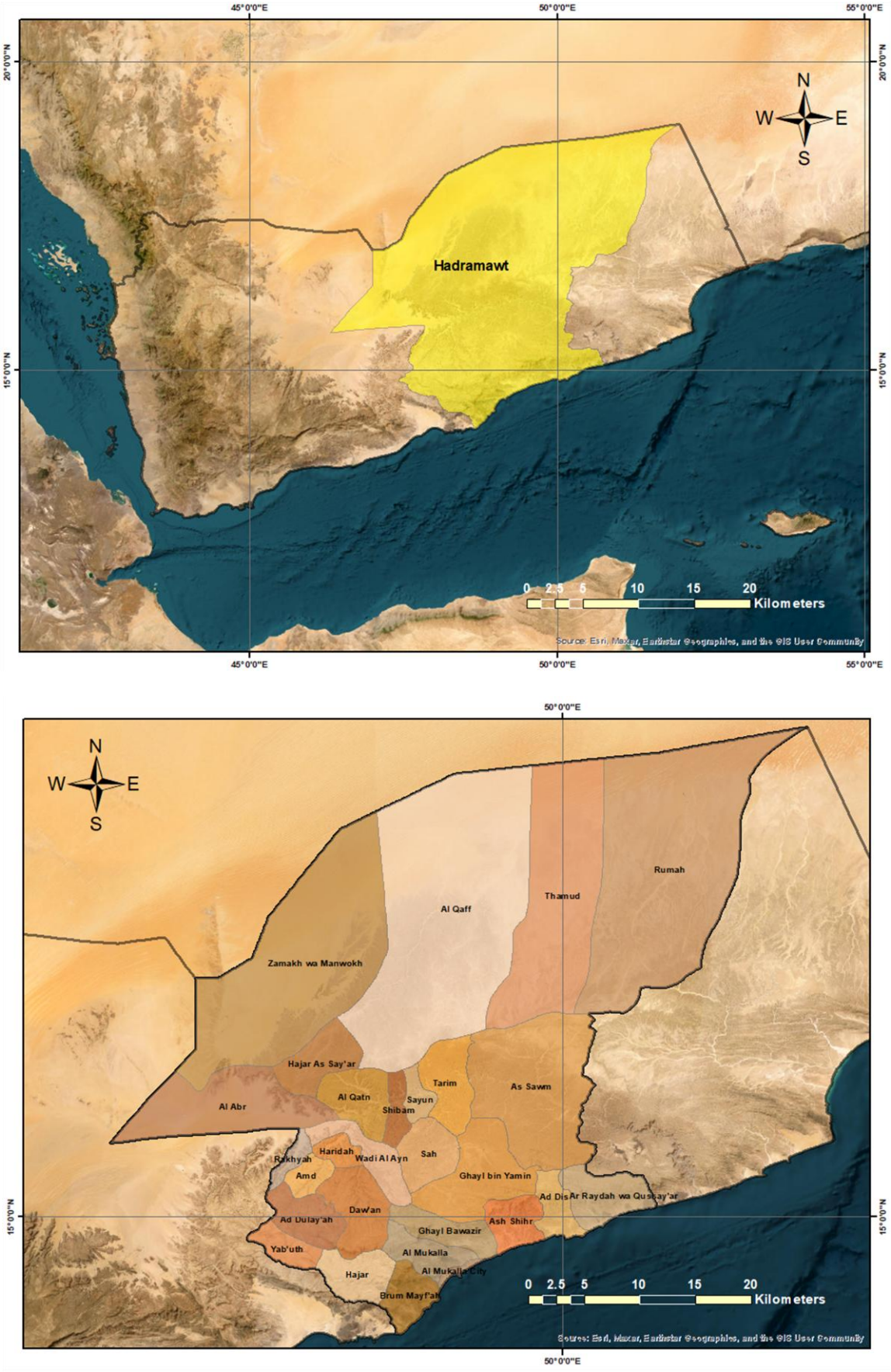


**Fig. 21**: ***Upper***: depicts the geographic location of **Hadramout** at the **Arabian Peninsula**; ***Lower***: shows the districts of **Hadramout governorate**. (Source: **the author**).

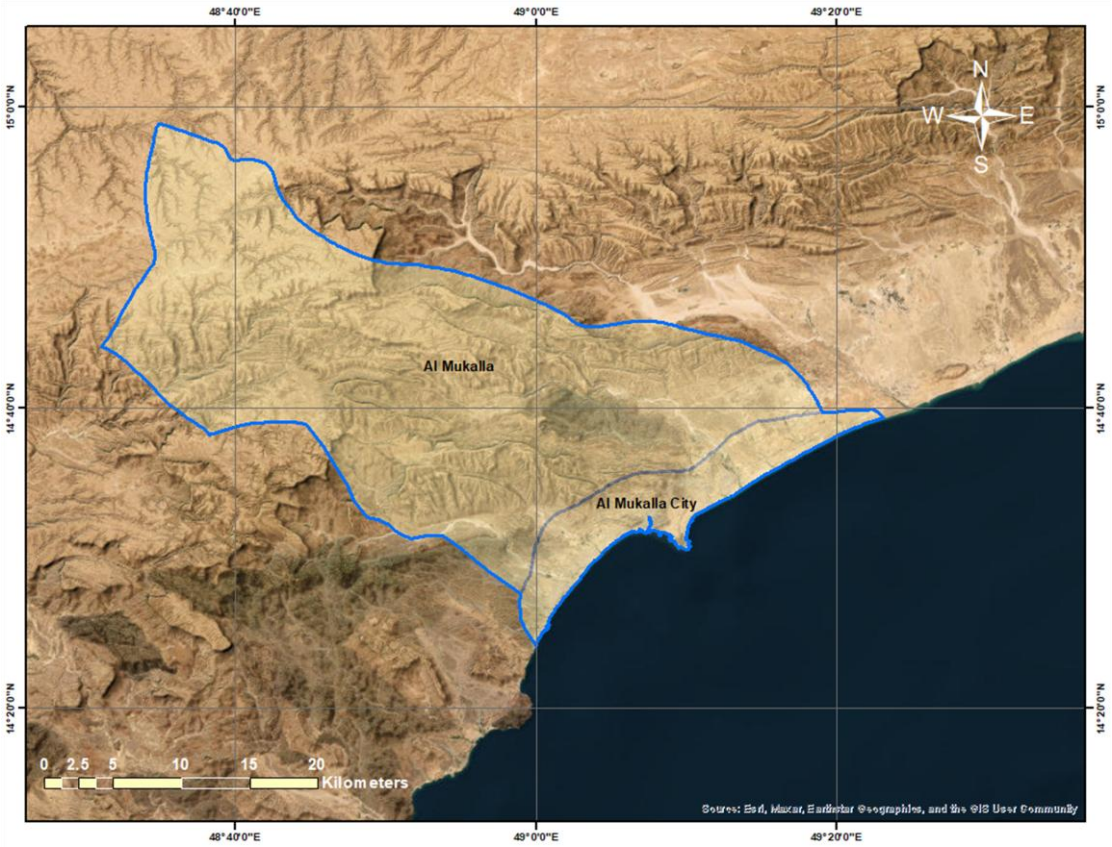


**Fig. 22**: Depicts the **Al-Mukalla Governorate** and **Al-Mukalla City** location. (Source: **the author**).

**Fig. 23**: Shows part of **Al-Mukalla City** (Source: **www.flickr.com**).

# IV.2. Flood History in Hadramout Governorate and Al-Mukalla City

**Hadramout governorate** and its **capital**, **Al-Mukalla**, have seen many major flooding occurrences in recent years, owing mostly to strong seasonal rains. These floods have caused extensive damage to infrastructure, residences, and agricultural grounds, resulting in loss of life and displacement (**Figs. 24** & **25**).

- **2008 floods:**

Tropical Storm **03B** hit **Hadramout** and **Al-Mahra governorates** in **October 2008**, causing heavy rain and flooding. The storm dumped over **91 mm** of rain over **30 hours**, substantially more than the average **5-6 mm**. This event claimed **73** lives, left **17** persons missing, and caused major damage to infrastructure and residences[33].

- **2021 Floods:**

In **May 2021**, heavy rainfall caused flooding in the city of **Tarim**, located in **Hadramout**. The torrential rains resulted in the deaths of **13** individuals and displaced many families[34].

- **2024 Floods:**

In **April 2024**, **Al-Mukalla**, the capital city of **Hadramout Governorate**, faced considerable flooding as a result of heavy rainfall. The severe rains caused widespread flooding in the city, resulting in significant damage to infrastructure and residences. The floods severely impacted **internally displaced persons** (**IDP**) camps in the governorate, inflicting widespread destruction and displacement. These repeated floods show **Hadramout** and **Al-Mukalla's** vulnerability to extreme weather events, emphasizing the importance of better flood control and infrastructure resilience.

[33] https://www.preventionweb.net/publication/damage-losses-and-needs-assessment-october-2008-tropical-storm-and-floods-hadramout-and?utm_source=chatgpt.com
[34] https://ensany.com/campaign/3699?utm_source=chatgpt.com

**Fig. 24**: The floods caused significant damage to the service and agricultural sectors – **Al-Mukalla**. (Source: **hodhodyemennews**).
https://hodhodyemennews.net/en_US/2024/04/18/floods-in-hadhramaut-cause-significant-damage-kill-one-person/

**Fig. 25**: The floods caused significant damage to the service and agricultural sectors – **Al-Mukalla**. (Source: **Daily Sabah**).
https://www.dailysabah.com/world/mid-east/flooding-from-heavy-seasonal-rains-kills-16-in-yemen

# IV.3. Climate Data Analysis

## Numeric Precipitation Data Analysis

The scene (Fig. 26) depicts a time series graphic of precipitation data from the **GPM** (**Global Precipitation Measurement**) mission. It plots precipitation in millimeters (**mm**) with time, from early **2018** to early **2024**. Below is a detailed description of time-series precipitation data:

## Key Observations

The plot highlights distinct peaks indicating extreme precipitation events, with the highest occurring in early **2019** and early **2023**, exceeding **80-100 mm**. Precipitation is sporadic, with long dry periods interrupted by short, intense rainfall events, possibly showing seasonal patterns. Extended low-intensity periods are evident between these peaks. The irregular and extreme spikes may reflect the impact of **climate change**, contributing to more intense and unpredictable rainfall patterns.

## Implications

High precipitation maxima may cause floods in sensitive regions such as **Hadramout** and **Al-Mukalla**, resulting in substantial infrastructure damage. Rainfall is sporadic, emphasizing the importance of rainwater harvesting and storage for resource management during dry years. Furthermore, this information is critical for building **early warning systems** to predict and mitigate the effects of extreme precipitation events.

## Recommendations

Long-term monitoring using **GPM** data is essential to assess the effects of climate variability in the region. Correlating precipitation peaks with flood or drought events can help understand their direct impacts, while analyzing seasonal and inter-annual variability can reveal patterns and trends. This data should guide the design of resilient drainage and storage infrastructure to handle heavy rainfall and water shortages.

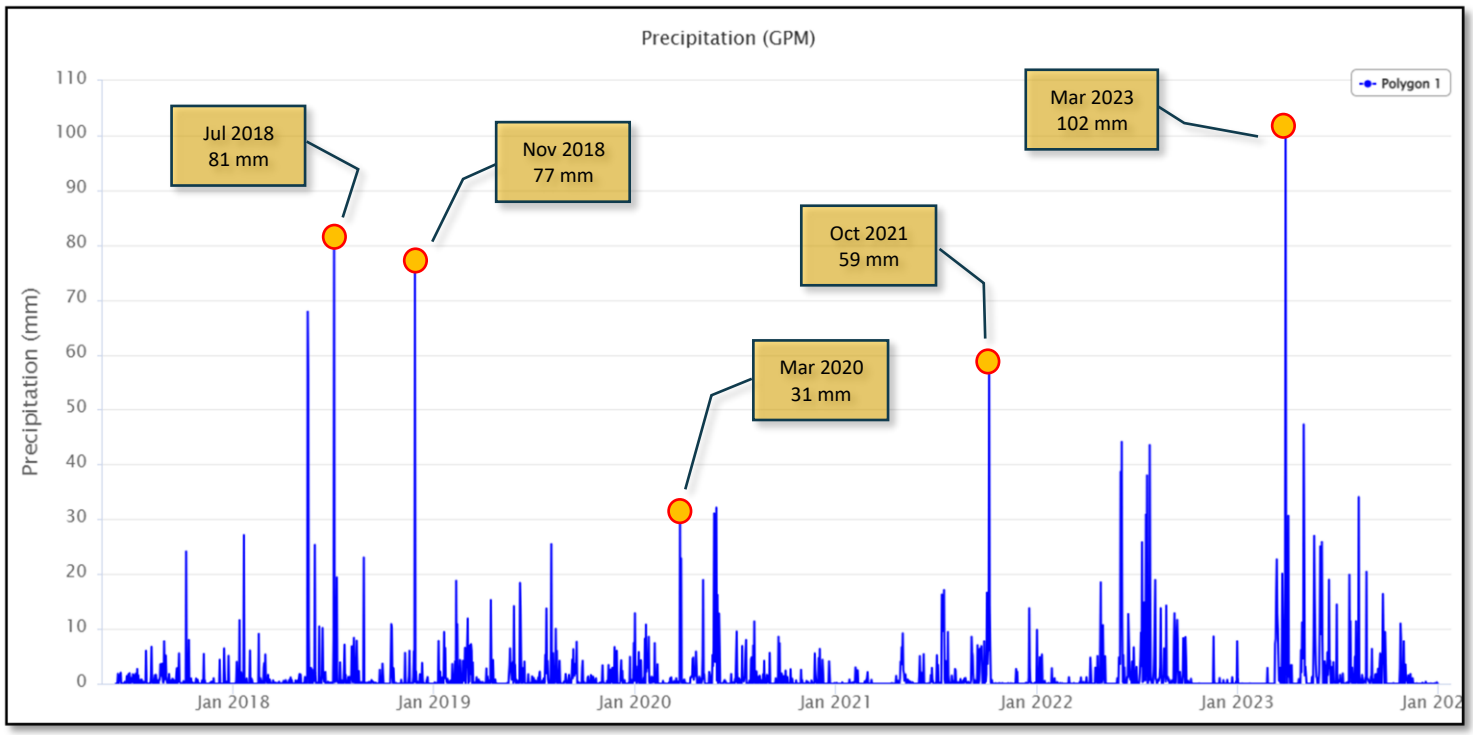


**Fig. 26**: The rainfall chart highlights the extreme variability of max. precipitation values in **Al-Mukalla** area from **2017** to **2023**. (Source: **Giovanni**).
https://giovanni.gsfc.nasa.gov/giovanni/#service=VtPf&starttime=&endtime=&dataKeyword=Precipitation

# Raster image Precipitation Data Analysis

## Analysis

### Precipitation Distribution and Geographical Context

Rainfall across the region shows significant spatial variation, increasing progressively from the southeastern coastal areas, such as **Al-Mukalla City**, toward the northern and western inland regions. Coastal areas, marked in **red (115–142 mm)**, experience relatively low rainfall, aligning with their arid to semi-arid climate. Inland areas show moderate rainfall levels, represented by **orange to yellow (143–202 mm)**, while the northern and western regions exhibit significantly higher rainfall, marked by **blue and green shades (292–396 mm)** (**Fig. 27**).

This stark contrast in precipitation levels is influenced by geographical factors, with inland highlands benefiting from orographic lifting due to topographic features, while

coastal zones remain drier. The map highlights these variations, emphasizing the need for tailored water resource management and infrastructure planning across the region.

### Implications

Low-lying coastal locations with minimal precipitation may still face flash flooding dangers from infrequent heavy rainfall events, particularly during extreme weather conditions. To address this, heavier rainfall locations in the inland regions might be targeted for rainwater collection and storage systems, which would help to feed the drier coastal zones. **Al-Mukalla City** should also implement climate-resilient urban development techniques to deal with the problems provided by low rainfall and probable extreme events. Furthermore, interior locations with higher rainfall are better adapted to agricultural activities, but arid coastal areas will require effective water management measures to maintain agriculture.

## Integrated Climate-Resilient Nexus Solutions for Hadramout

1. **Water-Climate Nexus**

   **Challenges:**

   Coastal areas like **Al-Mukalla** face water scarcity due to low rainfall, while inland regions with higher rainfall often lack adequate infrastructure for water harvesting. **Climate change** worsens the frequency and intensity of extreme events, such as flash floods and prolonged droughts.

   **Nexus Solutions:**

   To address this, rainwater harvesting systems should be implemented in high-rainfall inland areas, with the collected water used to replenish groundwater or supply arid coastal zones. Additionally, integrated desalination and groundwater recharge systems powered by renewable energy can ensure sustainable water availability. Monitoring precipitation patterns through satellite data, such as **GPM**, will help adapt water management strategies in real-time.

2. **Food-Climate Nexus**

**Challenges:**

Agriculture in inland areas with higher rainfall is increasingly vulnerable to erratic precipitation patterns and flooding. Coastal regions, grappling with water shortages, struggle to maintain agricultural productivity.

**Nexus Solutions:**

Promoting climate-resilient crops and advanced irrigation techniques, such as drip irrigation, can conserve water and enhance yields. Establishing efficient food storage and distribution systems that prioritize water-energy management will help mitigate climate-related disruptions to food security.

3. **Integrated Nexus-Based Solutions**

**Flood Management:**

Using rainfall data from maps and models will allow for better flood prediction and guide the strategic placement of infrastructure, such as dams and drainage systems. Green infrastructure, such as permeable pavements and urban green spaces, should be introduced to reduce runoff and mitigate flooding, especially in urban areas like **Al-Mukalla**.

**Policy and Governance:**

Policies must integrate water, energy, and food systems into climate adaptation strategies to foster sustainable development. Raising community awareness about climate-resilient practices and the **Nexus approach** will ensure effective stakeholder participation.

4. **Climate Change Resilience Through the Nexus Approach**

The **Nexus approach**, which recognizes the interconnections between water, energy, and food systems, offers a holistic solution to climate challenges in Hadramout. By addressing multiple dimensions simultaneously, it enhances resource use efficiency, mitigates environmental impacts, and boosts the region's capacity to adapt to climate variability, fostering long-term sustainability.

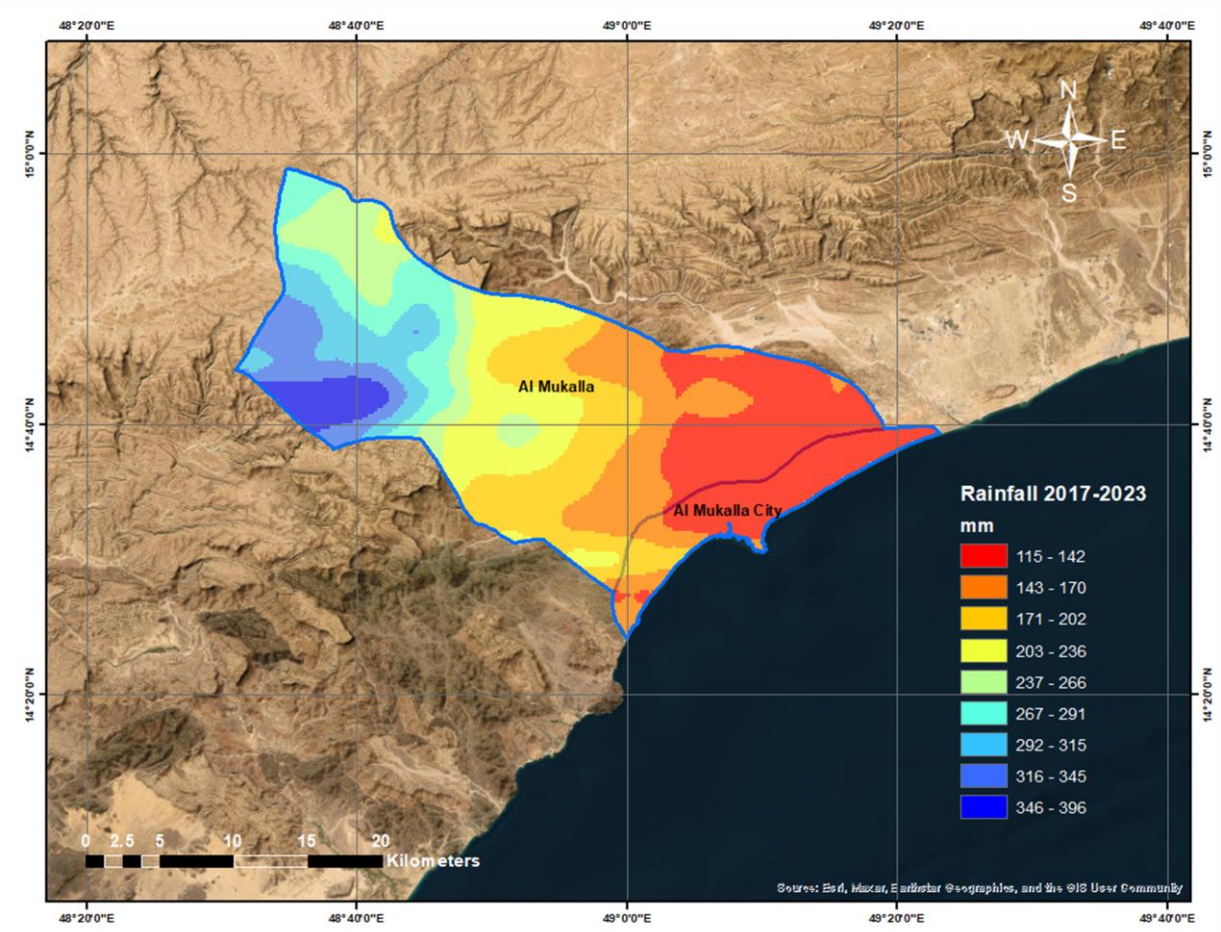


**Fig. 27**: Shows the rainfall distribution within **Al-Mukalla district and Al-Mukalla city** (Source: **the author**).

# Marib Governorate

# V. Climate Change Impacts: Marib

## V.1. Overview

### Geography of Marib Governorate

**Marib** is located in the northeastern part of **Yemen** on the **Arabian Peninsula**, approximately **173** kilometers east of the capital, **Sana'a**. Geographically, it lies at the edge of the **Rub' al Khali** (**Empty Quarter**), the largest continuous sand desert in the world, and is bordered by mountainous terrain to the west and expansive desert plains to the east (**Fig. 28**). Historically, **Marib** served as a critical hub connecting the **southern Arabian** trade routes to the northern regions, playing a significant role in the incense trade. Its strategic position between fertile valleys and desert landscapes made it a vital area for ancient civilizations, such as the **Sabaean Kingdom**.

Historically, it was the center of the old **Sabaean** monarchy, with **Marib** acting as the capital. The area is notable for the ruins of the **Great Dam** of **Marib**, an ancient engineering marvel. The **Great Dam** of **Marib**, constructed in the **8th** century **BC**, was a monumental feat that transformed the region into a fertile oasis, supporting agriculture and sustaining the **Sabaean** civilization. However, its collapse in the **6th** century **AD** led to significant environmental and societal changes, contributing to the decline of the **Sabaean kingdom**[35] [36] (**Figs. 29** & **30**).

[35] https://www.amusingplanet.com/2018/11/the-collapse-of-marib-dam-and-fall-of.html?utm_source=chatgpt.com

[36] Britannica. *Marib*. Retrieved from https://www.britannica.com/place/Marib

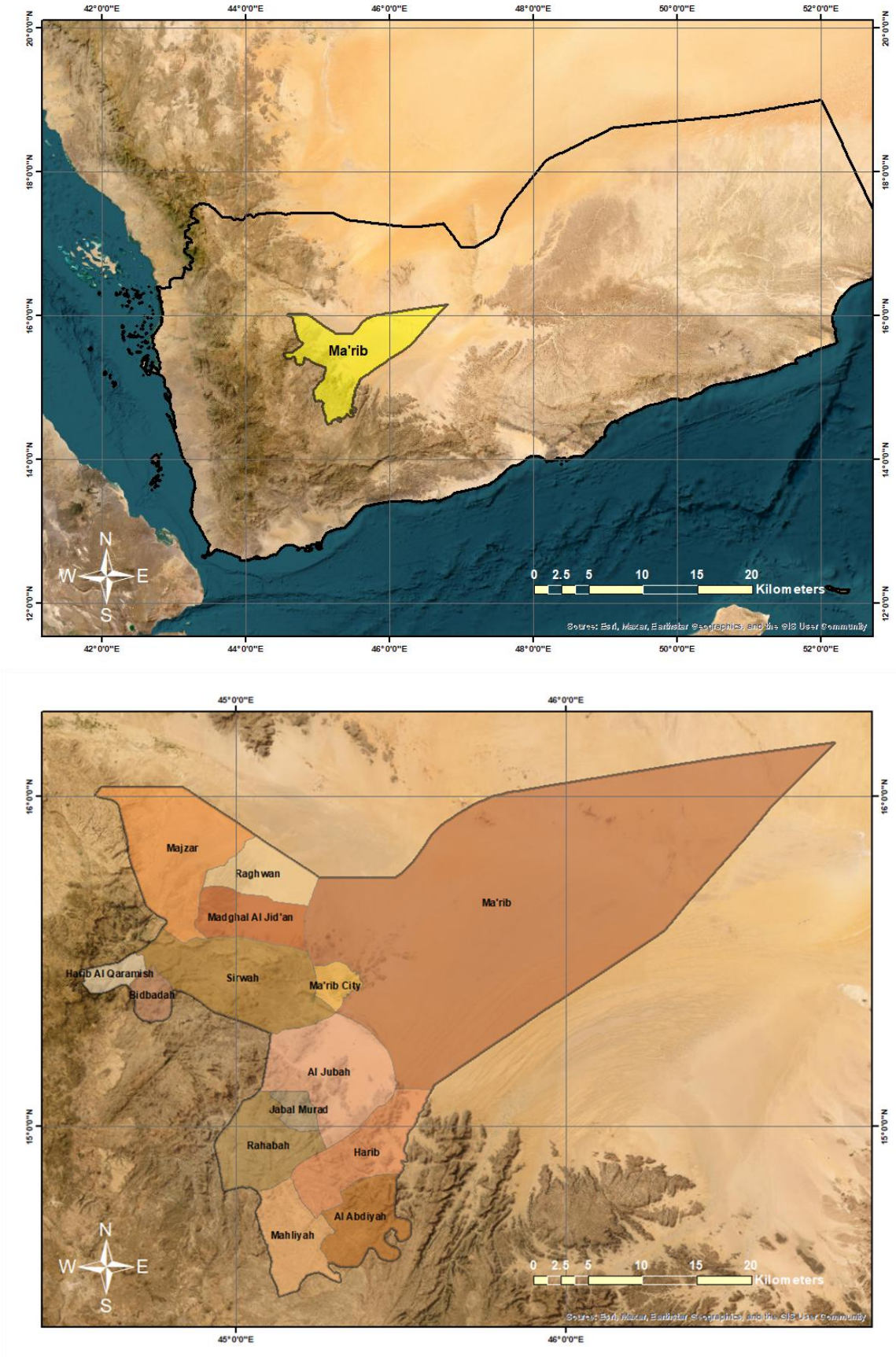


**Fig. 28**: ***Upper***: depicts the geographic location of Marib at the **Arabian Peninsula**; ***Lower***: shows the districts of **Marib Governorate**. (Source: **the author**).

**Fig. 29**: Shows the Ruins of the ancient Barran Temple, **Marib** (Source: **https://www.britannica.com**). https://www.britannica.com/place/Marib?utm_source=chatgpt.com

**Fig. 30**: The photograph depicts the ruins of the Great Dam of **Marib**. (Source: **amusingplanet**). https://www.amusingplanet.com/2018/11/the-collapse-of-marib-dam-and-fall-of.html?utm_source=chatgpt.com

**Marib** has seen recurring floods in recent years, which have been exacerbated by **climate change** and ongoing conflicts. Heavy rains caused catastrophic flooding in **August 2020**, affecting over **35,000** homes across **Yemen**, with **Marib** among the hardest afflicted. The floods caused severe damage to infrastructure, residences, and displacement camps, exacerbating the difficulties encountered by internally displaced people (**IDPs**) in the region (**Figs. 31** & **32**).

Rains and flooding at **21 Marib** displacement sites have destroyed **600** shelters and damaged **2,800** more, affecting over **20,000** people. Floods have accelerated the spread of waterborne diseases such as cholera, malaria, and dengue fever, putting severe strain on health systems. The situation exacerbated in **2022**, when windstorms and accompanying floods affected almost **150,000 Marib** inhabitants and **IDPs**. The storms wrecked shelters, destroyed personal items, and caused severe animal and property losses. These frequent natural disasters have stretched **Marib's** already limited resources, stressing the urgent need for comprehensive disaster management techniques and robust infrastructure to protect vulnerable populations[37] [38] [39].

**Fig. 31**: Shows the floods in **Marib** province, **2020** (Source: **almashareq**). https://almashareq.com/en_GB/articles/cnmi_am/features/2020/10/07/feature-02

[37] IOM, 2024
[38] WHO, 2024
[39] https://www.bbc.com/news/articles/cql3d1p6yq6o?utm_source=chatgpt.com

**Fig. 32**: **Marib governorate** in **Yemen** had extraordinary severe rainfall followed by storms, high gusts with dust, and a massive flow of floods. (Source: **Executive Unit IDPs**). ttps://www.exuye.org/en/791

# V.2. Climate Data Analysis

## Numeric Precipitation Data Analysis

**Figure 33** illustrates a time series graph of precipitation data from the **GPM** (**Global Precipitation Measurement**) mission. It shows precipitation in millimeters (**mm**) over time, from **Jan. 2017** to **Dec. 2023**. The following is a detailed discussion of time-series precipitation data:

1. **Peak Precipitation Events**:

The chart reveals several distinct spikes in precipitation, indicating extreme rainfall events. Notable peaks occurred in early **2019**, late **2022**, and early **2023**, with precipitation levels surpassing **100 mm** during some instances.

2. **General Precipitation Trends:**

Rainfall appears sporadic, characterized by extended periods of low or no rainfall interrupted by short but intense precipitation events. This pattern suggests that

rainfall distribution is uneven throughout the year, potentially linked to seasonal or specific weather systems.

**3. Low-Intensity Periods:**

Prolonged intervals of minimal rainfall are evident, particularly between the peak events. These dry spells highlight the region's vulnerability to water shortages and drought conditions.

**4. Potential Implications:**

The extreme rainfall spikes suggest a heightened risk of flooding, especially in areas with insufficient drainage infrastructure. Additionally, the sporadic and unpredictable rainfall patterns emphasize the importance of water management strategies, such as rainwater harvesting during heavy rainfall periods and preparedness for droughts during extended dry spells.

**5. Climate Change Connection:**

The irregularity and intensity of precipitation events may reflect the influence of climate change, potentially driving more extreme and less predictable weather patterns in the region. This reinforces the urgency for climate adaptation strategies.

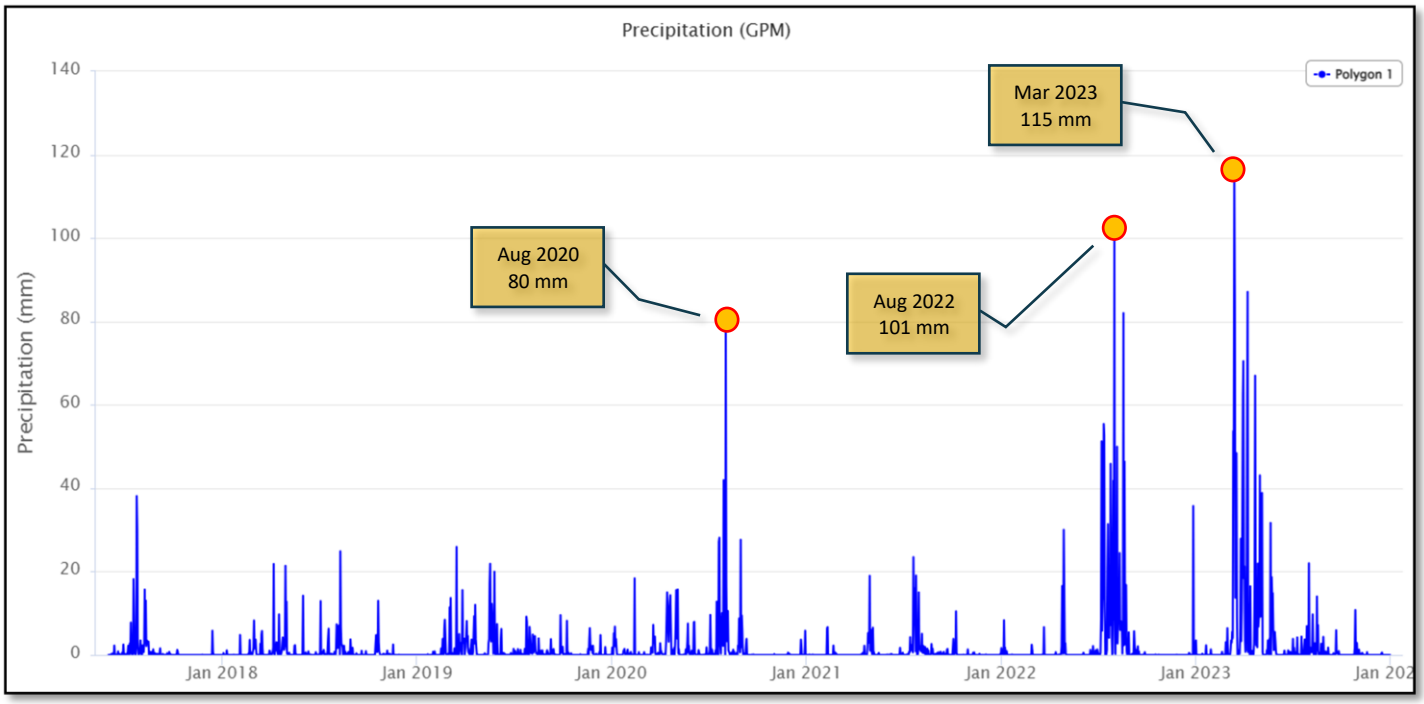


**Fig. 33**: Shows the rainfall distribution within **Marib Governorate** from **2017 – 2023**. (Source: **Giovanni**).
https://giovanni.gsfc.nasa.gov/giovanni/#service=VtPf&starttime=&endtime=&dataKeyword=Precipitation

## Raster Precipitation Data Analysis

Fig. 34 is a thematic map showing the annual rainfall distribution (in **mm**) from **2017** to **2023** for a region, likely in **Yemen**, as indicated by the labeled districts such as **Marib City**, **Al Jubah**, and **Harib**. Key observations include:

### Description

**1. Rainfall Ranges:**

The map (**Fig. 33**) uses a color gradient to display annual rainfall ranges: Red (**124-170 mm**) represents areas with the least rainfall, predominantly in the northern and eastern parts; Orange to Yellow (**171-262 mm**) indicates areas with slightly higher rainfall, covering much of the central region; Light Green to Dark Green (**263-354 mm**) shows moderate rainfall regions; and Light Blue to Dark Blue (**447-539 mm**) highlights areas with the highest rainfall, concentrated in the southern and southwestern areas.

**2. Geographical Layout:**

The map illustrates distinct rainfall patterns across the region, highlighting clear geographic variations. **Northern** and **eastern** parts, such as **Majzar** and **Raghwan**, experience the lowest rainfall levels, as shown by the red and orange zones. Central areas, including **Marib City** and its surrounding districts, receive moderate rainfall, represented by yellow and green shades. In contrast, southern areas, like Al **Abdiyah** and **Mahliyah**, stand out with significantly higher rainfall, depicted in blue tones. This marked increase in rainfall in the south could be attributed to orographic effects or specific climatic conditions influencing the region.

### Suggested Actions and Insights

**1. Climatic Analysis:**

The fluctuation in rainfall reveals potential climatic changes across the region, recommending specialized resource management techniques. **Southern** locations with higher rainfall could benefit from improved agricultural initiatives and water resource management projects to help them reach their potential. **Northern** and eastern locations, which receive less rainfall, may require targeted drought mitigation

activities, such as water conservation, harvesting techniques, and sustainable resource planning.

**2. Data Usability:**

The map (**Fig. 33**) provides specialized information for hydrological planning, urban growth, and environmental conservation based on rainfall availability in each **district**.

**3. Policy Implications:**

Sustainable techniques such as enhancing groundwater recharge or introducing drought-resistant crops should be focused in regions with low rainfall, whilst high-rainfall areas might focus on implementing flood management systems to decrease hazards during periods of heavy rainfall.

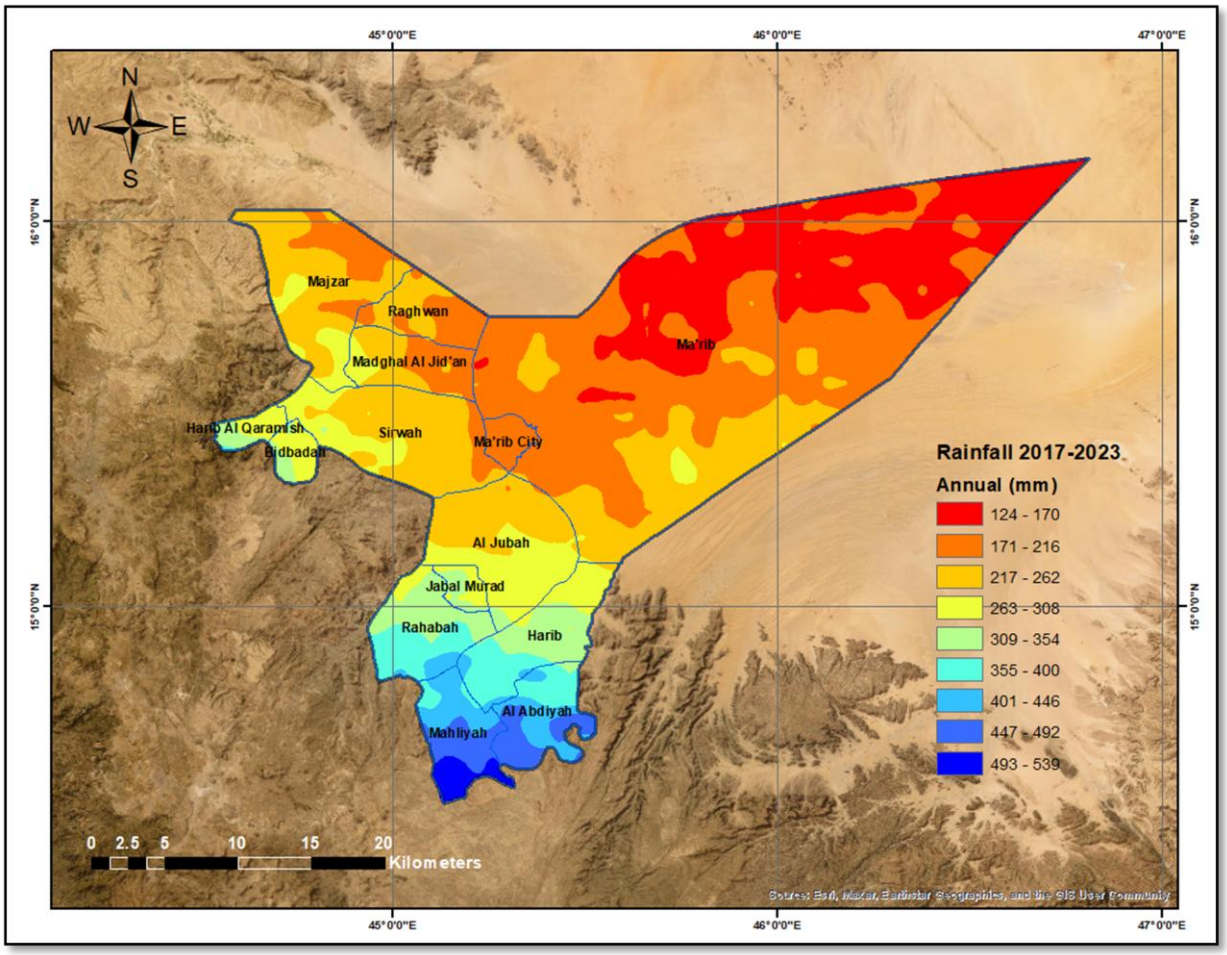


**Fig. 34**: Shows the max. annual rainfall distribution within **Marib districts for the years 2017-2023.** (Source: **the author**).

## Overview of the Flood hazard Map

From **Fig. 35**, the flood hazard assessment map for Internally **Displaced Persons (IDP)** sites in **Marib governorate**, **Yemen**, is based on a model produced in **January 2023**. It employs hydraulic modeling using **HEC-RAS** to estimate flood depth and hazard levels across different areas, providing critical insights for disaster preparedness and risk mitigation. The classification of flood hazards follows the **US Federal Emergency Management Agency (FEMA)** guidelines, which categorize hazards based on depth and velocity, ensuring a standardized approach to assessing flood risks[40]. Such modeling is essential for identifying vulnerable populations and implementing effective flood response strategies[41].

## Key Observations

The **Flood Hazard Classification** map categorizes flood severity into five levels: **Low** hazard (**0-0.2 $m^2/s$**), **Medium** hazard (**0.2-0.5 $m^2/s$**), **High** hazard (**0.5-1.5 $m^2/s$**), **Very high** hazard (**1.5-2.5 $m^2/s$**), and **Extreme** hazard (**>2.5 $m^2/s$**). The **Marib Dam** and its reservoir exhibit extreme flood hazard levels, with a large red area indicating the highest risk. The **IDP** Sites and Flood Exposure analysis identifies internally **displaced person (IDP)** sites based on their flood exposure: **23** sites in high hazard areas, **20** in **medium** hazard areas, **29** in **low** hazard regions, and **21** with unknown hazard levels, requiring further analysis. **Regarding Geographical Risk Distribution**, the **western** and **southern** parts of the **governorate**—especially around **Marib Dam**—face the highest flood risks, while the eastern and northeastern regions are less prone to severe flooding, with lower hazard levels and scattered **IDP** settlements.

The map emphasizes the need of disaster preparedness and **early warning**, with authorities directed to use this data to relocate high-risk **IDP** camps or construct flood protection measures.

## Suggestions for Use

[40] Federal Emergency Management Agency. (2021). *Guidance for Flood Risk Analysis and Mapping – Floodway Analysis and Mapping*. FEMA.
[41] REACH, 2023.

In terms of infrastructure planning, **humanitarian** organizations and **government** agencies should prioritize flood-resistant infrastructure in high-risk areas. Furthermore, regular updates and monitoring are critical due to the dynamic nature of climate change and extreme weather, which necessitate periodic revisions to the flood model. In conclusion, the **Marib governorate** flood danger map is an important tool for disaster risk management, particularly for **IDP** protection. However, improvements in data resolution, field verification, and infrastructure mapping would make it more effective. **Humanitarian** agencies should use this approach to select interventions and protect vulnerable communities from flood-related disasters[42,43].

## How Can the Nexus Approach Be Implemented with Climate Change?

### 1. Water Security & Flood Management

To enhance flood resilience in **IDP** camps, a multi-layered approach combining technology, ecological restoration, and infrastructure planning is essential. IoT-based flood monitoring sensors can be deployed to detect rising water levels in real time, triggering early warnings to alert communities before flooding occurs. At the same time, nature-based solutions, such as watershed restoration, reforestation, and wetland conservation, help reduce runoff and improve water retention. Additionally, **climate-resilient infrastructure**—including elevated housing, reinforced drainage systems, and flood barriers—should be prioritized, with relocation strategies considered for high-risk areas. By integrating smart monitoring, sustainable land management, and resilient construction, this approach ensures long-term water security and flood preparedness for vulnerable populations.

### 2. Energy Security & Climate Adaptation

Ensuring reliable energy access in flood-prone **IDP** sites requires **renewable and decentralized solutions** that enhance resilience to climate extremes. Solar-powered water pumps and desalination systems can provide a stable water supply during

[42] Federal Emergency Management Agency (FEMA). (2021). *Flood Depth and Analysis Grid Guidance*. Washington, D.C.

[43] REACH. (2023). Yemen - Flood Hazard of IDP Sites, Ma'rib Governorate.

extreme weather events, reducing dependency on vulnerable infrastructure. Additionally, mini-grids and solar panels can offer decentralized energy solutions, ensuring uninterrupted power for essential services such as lighting, communication, and medical facilities during disasters. By integrating **renewable energy with climate adaptation strategies**, this approach strengthens both water and energy security, enhancing the sustainability and self-sufficiency of displaced communities.

**3. Food Security & Sustainable Land Use**

Enhancing food security in flood-prone areas requires climate-smart agricultural practices that adapt to changing environmental conditions. Flood-resilient farming techniques, such as hydroponics, floating farms, and raised-bed agriculture, can sustain food production even in waterlogged conditions. Additionally, managed water retention systems can harness floodwaters for irrigation, improving water availability during dry periods. By integrating innovative farming methods with sustainable water management, this approach ensures long-term food security while enhancing ecosystem resilience in vulnerable regions.

**4. Data-Driven Policy & Climate Resilience**

Effective flood risk management requires **data-driven decision-making** that integrates geospatial analysis, disaster planning, and cross-sector collaboration. **ArcGIS and remote sensing** can be used to map climate change impacts on flood frequency, helping to identify high-risk zones and guide mitigation efforts. Integrated disaster planning, in coordination with **humanitarian** agencies, ensures that **IDP** site selection incorporates flood risk models to minimize exposure. Additionally, **Nexus-based governance** promotes a balanced approach to water management**,** agriculture, and flood mitigation, fostering resilience through multi-sector cooperation. By leveraging advanced analytics and coordinated policies, this approach strengthens climate adaptation strategies for vulnerable communities.

Integrating **IoT, GIS, RS and Nexus approaches** can enhance climate resilience in flood-prone **IDP** areas. This requires **multi-sectoral cooperation** among environmental agencies, **humanitarian** organizations, and **government** authorities.

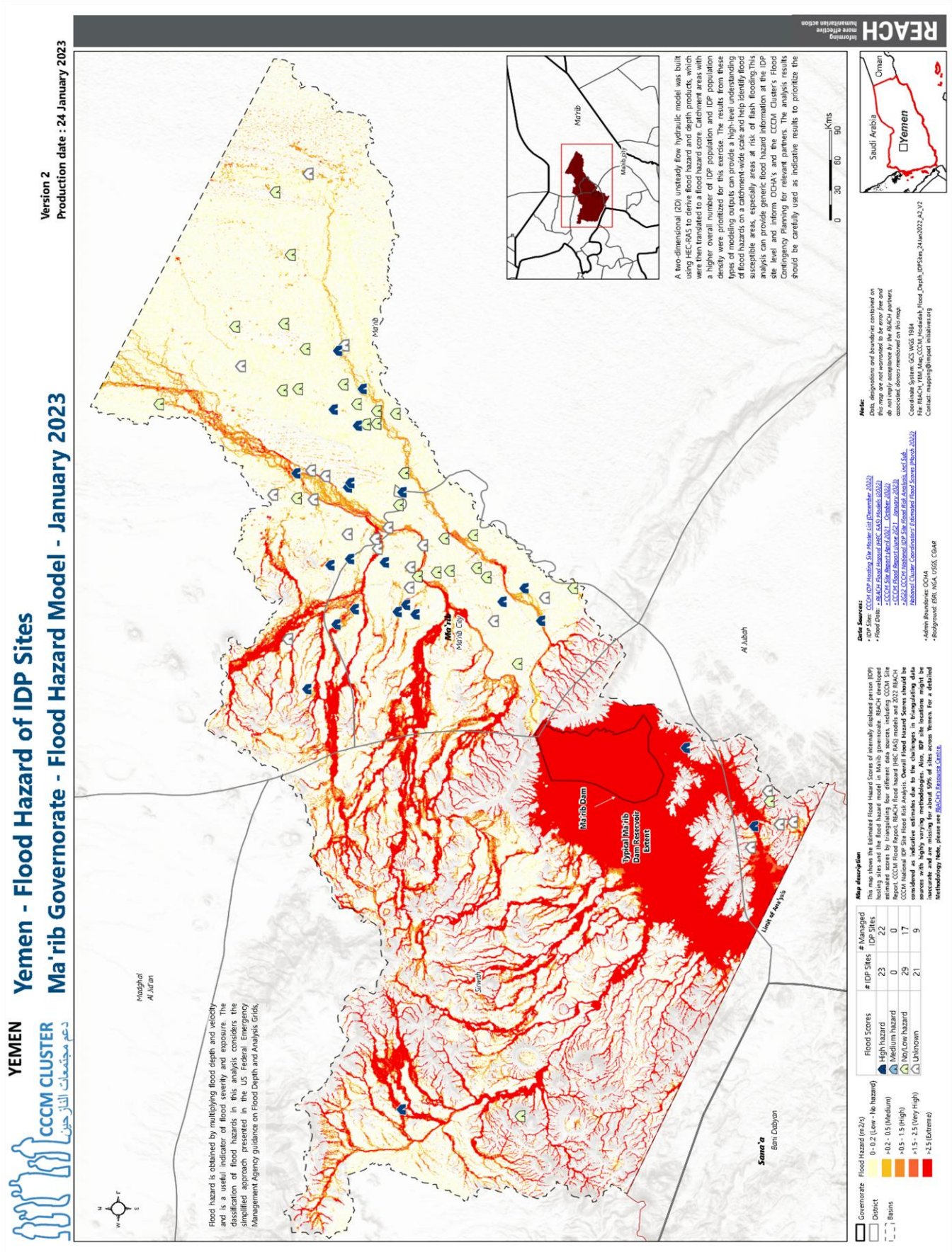


**Fig. 35:** Shows the flood hazard sites in **Marib Governorate.** (Source: **REACH**).

# Hajjah Governorate

# VI. Climate Change Impacts: Hajjah

## VI.1. Overview

### Geography of Hajjah Governorate

**Hajjah Governorate**, located in northeastern **Yemen** (**Fig. 36**), has a diversified geography that includes rugged highlands and low-lying coastal plains along the **Red Sea**. This diverse landscape increases the region's susceptibility to seasonal flooding[44] (**Figs. 37** & **38**).

In recent years, **Hajjah** has experienced substantial flooding, particularly during the rainy season. For example, in **August 2024**, heavy rains caused widespread flooding in various **Yemeni governorates**, including **Hajjah**, leading in infrastructure destruction and community displacement[45].

The impact of these floods is amplified by **Yemen's** ongoing humanitarian crisis, where prolonged conflict has already stretched resources and infrastructure. Flooding ruins houses, disrupts livelihoods, and raises the danger of waterborne infections, further testing impacted populations' resilience.

Implementing **early warning systems**, strengthening infrastructure, and promoting sustainable land management techniques are among the efforts being made in **Hajjah**

[44] https://yemen.unfpa.org/en?utm_source=chatgpt.com
[45] Berghof Foundation & Political Development Forum, 2021. https://yemenlg.org/governorates/marib/?utm_source=chatgpt.com

to reduce flood risk. However, continuous conflict and inadequate resources provide substantial hurdles for these projects.

### Box 2: How Other Organizations Report Flood Impacts?

"Flooding in **Yemen** has left at least **57** people dead and thousands displaced, the **UN** has said. More than **34,000** families were affected by the heavy rains, which began in late June and intensified in early **August**, according to the UN humanitarian affairs office (OCHA).

It has worsened the country's "already dire humanitarian situation" as millions grapple with the impact of a civil conflict that began nearly **10** years ago, the UN body added."

"The magnitude of this disaster is overwhelming, and the humanitarian needs are enormous," said **Matt Huber**, the International Organization for Migration (IOM)'s acting chief of mission in **Yemen**."

"Regions affected by the flooding include **Hodeidah**, **Hajjah**, **Taiz** and **Marib**. **Hodeidah** is among the hardest hit areas. Flooding there has displaced more than **6,000** families and caused widespread destruction to homes and essential services, according to the UN. Roads were closed and access to affected areas remained challenging, the body added. The IOM says it is ramping up emergency operations in the country (**Source: BBC New**)."

In **2020**, the situation was particularly grave, with over half a million people directly affected by water by September. A total of **189** districts in **19** governorates were affected, with about **44** persons killed. The **Ministry of Public Health and Population** in **Sana'a** estimates **250** casualties and **131** deaths in northern **Yemen** alone. Several international assessments suggested that the lives of tens of thousands of **Internally Displaced People (IDPs)**, many of whom were already in hazardous shelters as a result of the violence, were significantly harmed. **Marib**, **Hajjah**, **Al-Hodeidah**, and **Sana'a** were the most hit **governorates** in this case. According to the **August 2022 OCHA** Situation Update, heavy rains have affected more than **51,000** households across the

country since **mid-April 2022**, with **Marib** and **Hajjah governorates** being the worst-hit, with over **13,000** and **9,000** households affected, respectively, and the majority of those affected reportedly living in displacement sites. Along **Yemen's** western coast, **Abs** in **Hajjah governorate** is one of the most devastated districts, with one of the biggest concentrations of **IDPs** and vulnerable people in the country. Since **2019**, **Hajjah** has had a series of torrential rains that have devastated shelters in **IDP** sites and infrastructure, leaving thousands of people in need and hampering **humanitarian** shipments[46] (**Figs. 39** & **40**).

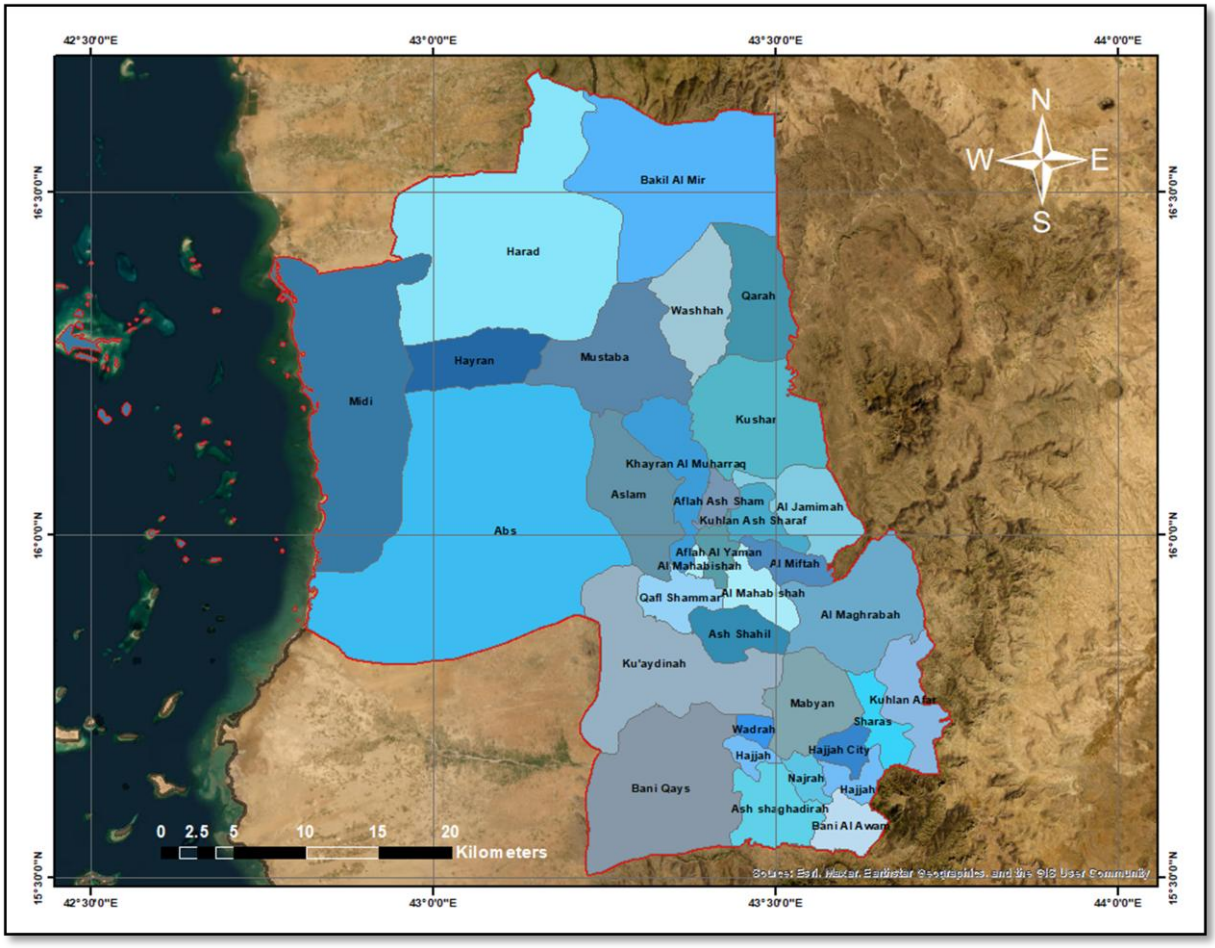


**Fig. 36**: Shows displaced families affected by rain and floods in **Hajjah** province (Source: **the author**).

[46] REACH, 2022. https://data.unhcr.org/es/documents/details/91763

**Fig. 37**: **Hajjah** City (Source: https://it.pinterest.com/pin/511228995215395583/).

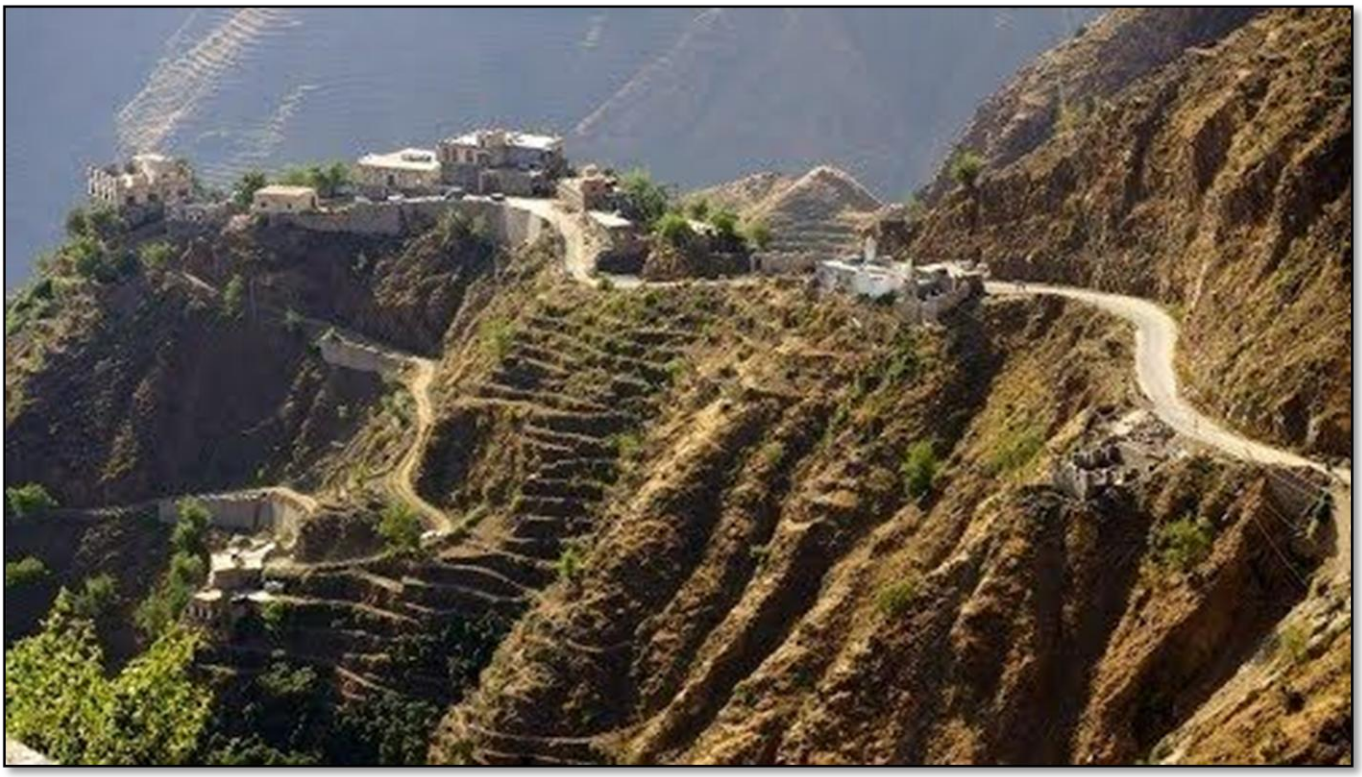

**Fig. 38**: **Hajjah governorate** (Source: **Alchetron**). https://alchetron.com/Hajjah-Governorate

**Fig. 39**: Damage Caused by Rain and Floods in the Displaced Persons Camps in **Hajjah governorate**. (Source: **exuye.org**). https://www.exuye.org/en/2088

**Fig. 40:** Shows displaced families affected by rain and floods in **Hajjah** province (Source: **YemenTV**). https://en.yementv.tv/report-around-2000-displaced-families-affected-by-rain-and-floods-in-hajjah-province.html

# VI.2. Rainfall Analysis

## Analysis of the Rainfall Chart (Precipitation - GPM)

**1. Data Overview:**

The chart represents daily precipitation data from **January 1, 2017**, to **December 31, 2023** (Fig. 41). The y-axis (Precipitation in **mm**) indicates the daily rainfall amount, while the x-axis represents the timeline from **2017** to **2023**.

**2. Observations:**

The rainfall data shows high variability with alternating dry spells and intense precipitation events. A noticeable increase in extreme precipitation events is observed starting in early **2022**, with several peaks exceeding **140 mm**. Recurring wet and dry seasons are evident, though variability exists within each year. The highest rainfall peaks occur in **2022** and **2023**, suggesting a possible intensification of extreme weather events.

**3. Potential Implications:**

The increase in extreme precipitation events in recent years may be linked to climate variability or **climate change** impacts, leading to heightened flood risks, particularly in **2022** and **2023**. More frequent and intense rainfall spikes can exacerbate flooding, causing damage to infrastructure and disrupting ecosystems. Additionally, excessive rainfall creates favorable conditions for vector-borne diseases such as malaria and dengue, as stagnant water provides breeding grounds for mosquitoes, increasing public health concerns.

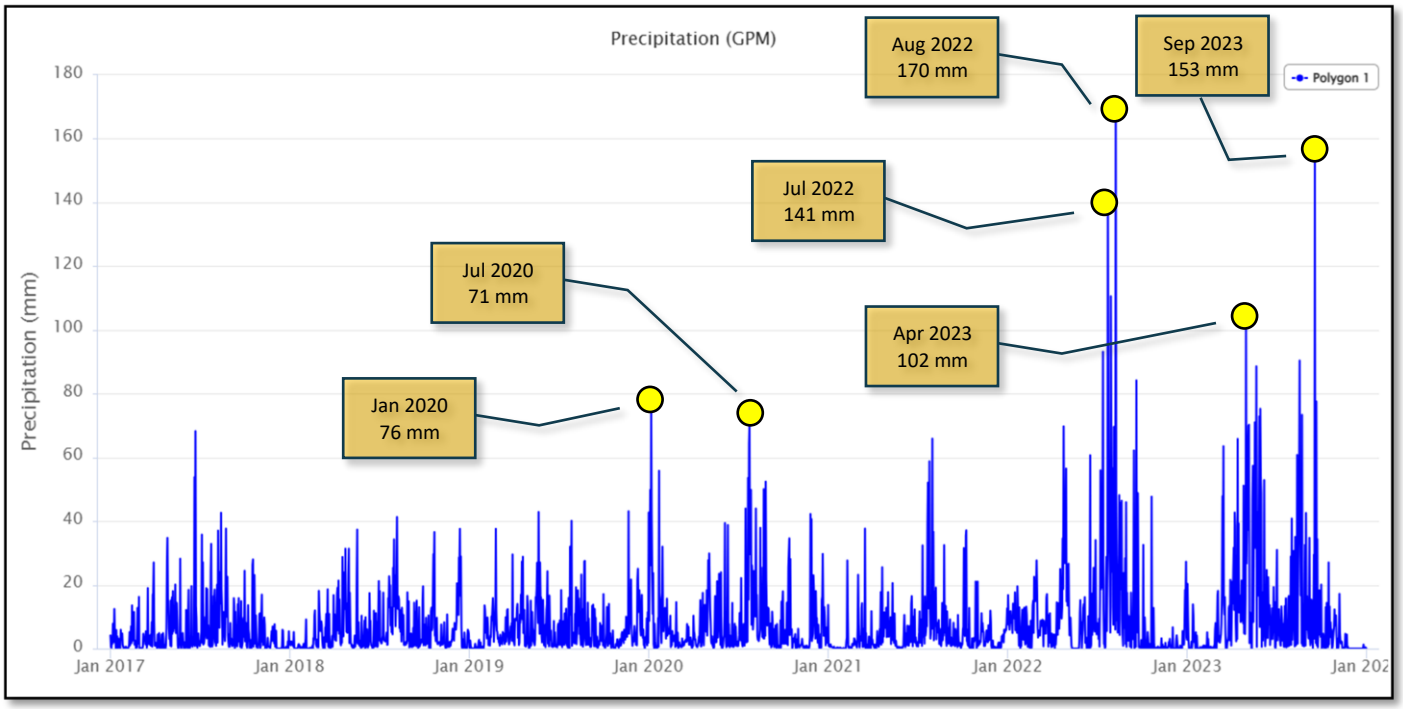


Fig. 41: Shows the historical rainfall intensity within **Hajjah Governorate** from **2017 – 2023**. (Source: **GPM**).

### 4. Hydrological & Climatic Context

The rainfall chart (**2017–2023**) indicates high variability in precipitation, with extreme rainfall events increasing from **2022** onward. The map provides a spatial representation of the terrain, showing how precipitation patterns may interact with geographical features such as coastal and mountainous areas (Fig. 41).

## Key Linkages Between Rainfall and Geography

### 1. Mountainous Areas and Rainfall Intensity

The eastern mountainous region, influenced by orographic lifting, likely receives significant rainfall as moist air rises over the terrain, enhancing precipitation. Heavy rainfall in **2022–2023**, as indicated in the chart, may have triggered landslides, flash floods, and increased runoff, leading to soil erosion and sediment transport

downstream. The presence of a river system further suggests that excess water flows toward coastal areas, potentially heightening flood risks in low-lying regions.

**2. Coastal Areas and Flood Risks**

Coastal zones are prone to flooding due to excess runoff from upstream rainfall events, especially when high rainfall coincides with tidal surges. The rainfall spikes observed in **2022** and **2023** suggest possible extreme weather events, such as storms or cyclones, which could have intensified coastal inundation and erosion.

**3. Climate Change and Rainfall Variability**

The increase in extreme precipitation in recent years, likely linked to **climate change**, is affecting both the mountains—leading to landslides and vegetation loss—and the coast, contributing to flooding and sea-level rise. The variability in rainfall further suggests unpredictable water availability, which could negatively impact agriculture, water resources, and public health, increasing the risk of disease outbreaks, such as vector-borne illnesses due to stagnant water in coastal flood zones (Fig. 42).

## Implications for Hydrological and Climate Risk Management

To address flood and erosion risks, implementing watershed management strategies in mountainous areas can reduce runoff and landslides, while enhancing coastal flood protection through measures like mangrove restoration and seawalls. The increased frequency of extreme rainfall emphasizes the importance of **early warning systems** and climate-resilient infrastructure to mitigate flash floods and storm surges. Additionally, high rainfall in low-lying areas creates breeding grounds for disease vectors, such as mosquitoes and waterborne pathogens, necessitating integrated environmental health monitoring to support effective epidemiological surveillance (Fig. 42).

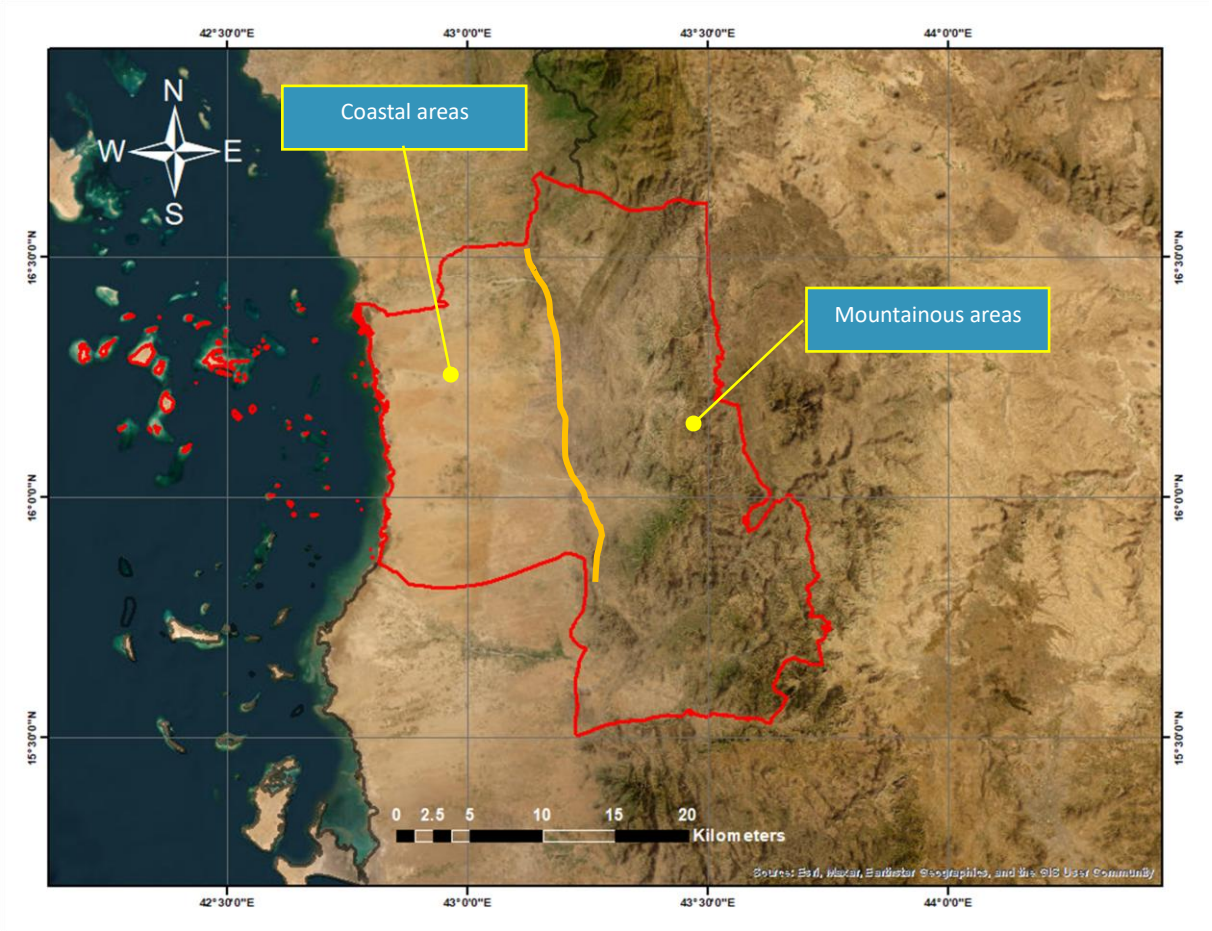


Fig. 42: Depicts the geographic varities of Hajjah province (Source: **the author**).

## Analysis of Rainfall Patterns, Geography, and Climate Trends of Hajjah Area

### 1. Rainfall Distribution and Geographic Influence

The rainfall distribution map (Fig. 43) reveals distinct geographic influences on precipitation patterns, with higher rainfall (dark blue shades) concentrated in central areas and lower precipitation (red/orange) in the eastern mountainous and western coastal regions. The eastern mountains experience reduced rainfall (yellow to red areas) due to rain shadow effects, where moist air loses its moisture before reaching higher elevations. Meanwhile, the western coastal region, despite receiving moderate rainfall, remains highly vulnerable to flooding as its low-lying terrain exacerbates the impact of upstream runoff during extreme precipitation events.

## Comparing the Rainfall Map with the Time-Series Chart (2017–2023)

Comparing the rainfall map (Figs. 41 & 43) with the time-series chart (**2017–2023**), highlights both long-term spatial patterns and recent extreme events. The time-series data indicate a rise in extreme rainfall events in **2022** and **2023**, which likely intensified storms in high-rainfall areas (blue zones) despite the map showing multi-year averages. Even in lower rainfall regions, such as the coastal and eastern areas, short but intense downpours may have triggered flash floods and erosion. Seasonal and interannual variability observed in the time-series chart aligns with spatial rainfall distribution, where transition zones (blue to yellow) experience fluctuating wet and dry periods, impacting agriculture, water resources, and ecosystem stability.

## Potential Implications and Risks

### *A. Climate Change & Hydrological Risks*

The increasing frequency of extreme rainfall events, as shown in the time-series chart (Fig. 41), combined with high rainfall accumulation in central areas, as seen in the map of Fig. 43, indicates an elevated risk of flash floods, particularly in valleys and lowland regions. The reduced rainfall in the mountainous areas may lead to drought conditions and decreased groundwater recharge, which could negatively impact water security and agriculture in the eastern regions. These hydrological risks highlight the potential consequences of **climate change** on both flood and drought occurrences.

### *B. Flood & Erosion Hazards*

Downstream flooding is a significant hazard as the river, originating from high rainfall zones, flows toward the coast, making low-lying coastal settlements particularly vulnerable to runoff-driven floods during extreme rainfall years. Additionally, high rainfall variability could exacerbate soil erosion in the mountainous regions, with sediment being transported downstream to lowlands, resulting in sedimentation in rivers that can degrade water quality and disrupt local ecosystems.

### *C. Epidemiological & Public Health Concerns*

Flood-related diseases pose a significant public health concern as stagnant water from extreme rainfall events (peaking in **2022–2023**) in high-rainfall areas creates ideal mosquito breeding grounds, increasing the risk of malaria, dengue, and waterborne diseases. Meanwhile, drought-affected areas in the mountainous regions may face water scarcity, malnutrition, and a rise in heat stress-related illnesses, further exacerbating public health challenges.

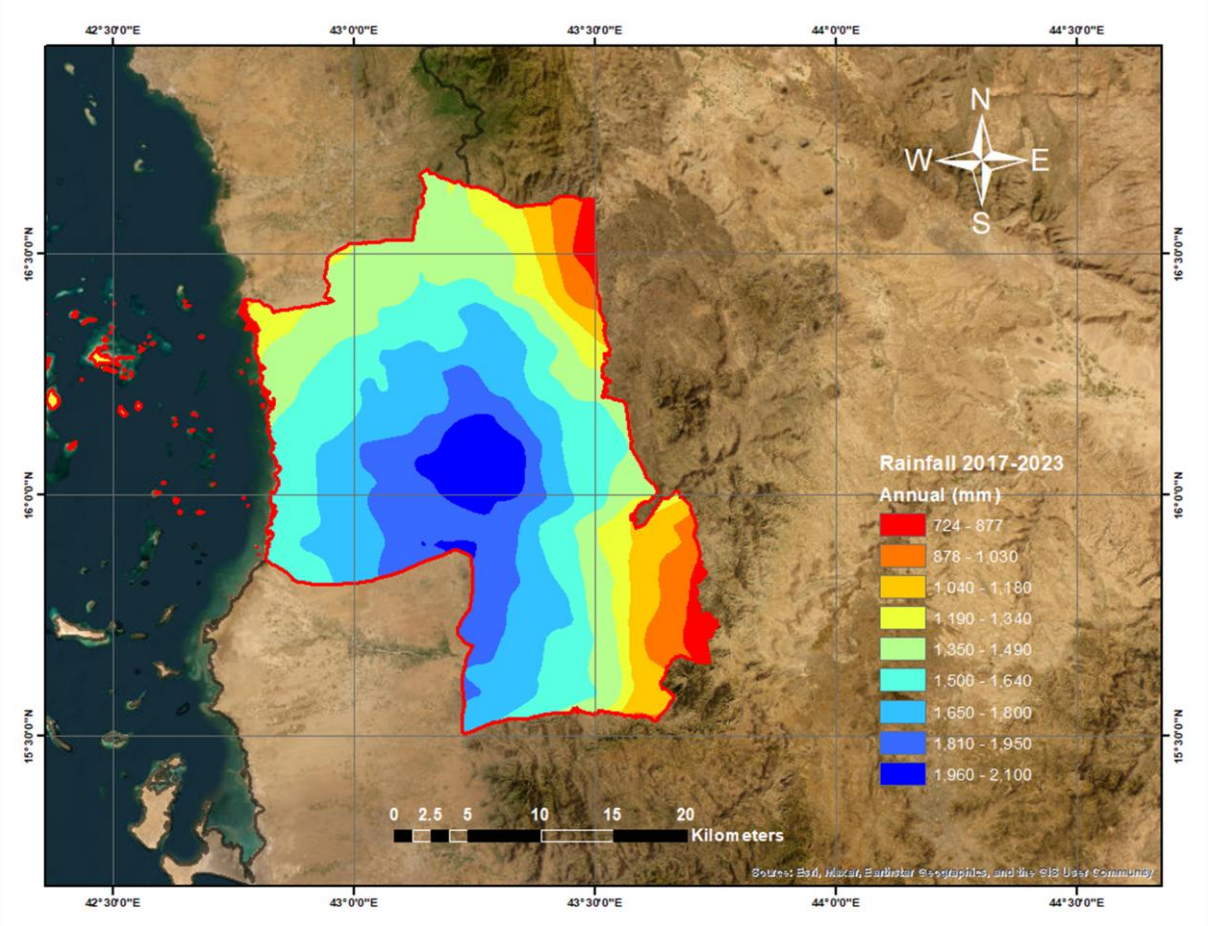


**Fig. 43**: Shows the intensity of rainfall distribution in **Hajjah** province (Source: **the author**).

# Enhancing Climate Resilience with the Nexus Approach

Implementing the **Nexus Approach** in the context of **climate change** entails integrating water, energy, and food management to improve sustainability and resilience. This approach recognizes the interdependence of these sectors and encourages policies and practices that maximize resource usage while mitigating climate impacts.

## Essential Strategies for Applying the Nexus Approach with Climate Considerations

1. **Integrated Resource Management**: Addressing the interdependence of the water, energy, and food sectors is critical. For example, sustainable wastewater management in agriculture exhibits the Water-Soil-Waste Nexus, in which cleaned wastewater is used for irrigation, conserving freshwater resources and lowering pollution[47].
2. **Using Modeling techniques**: Environmental modeling techniques help to comprehend complicated interactions inside the Nexus. The Nexus Tools Platform (NTP), created by the UNU Institute for Integrated Management of Material Fluxes and Resources (UNU-FLORES), is a web-based inventory of models that examine environmental resource management from a Nexus standpoint. This platform aids users in picking relevant tools for their research needs, promoting informed decision-making[48].
3. **Promoting Policy Coherence**: Ensuring that policies across sectors are consistent with climate goals is critical. The Water, Energy, and Food Security Nexus viewpoint promotes multidisciplinary solutions that improve sectoral cooperation rather than standalone initiatives. This technique aids in identifying synergies and balancing trade-offs between water, energy, and food security development goals[49].

[47] https://en.wikipedia.org/wiki/Nexus_Tools_Platform?utm_source=chatgpt.com
[48] https://en.wikipedia.org/wiki/Nexus_Tools_Platform?utm_source=chatgpt.com
[49] https://en.wikipedia.org/wiki/Water%2C_energy_and_food_security_nexus?utm_source=chatgpt.com

4. **Engaging Stakeholders**: Active participation by government agencies, the commercial sector, and civil society is required. Collaborative initiatives aid in avoiding unforeseen negative repercussions and devising policies, plans, and investments that capitalize on synergies and address trade-offs between sectors[50].
5. **Managing Climate and Trade Policy Intersections**: Recognizing the relationship between climate action and trade policies is becoming more crucial. For example, debates at COP29 focused on how trade policies such as carbon taxes might influence global emissions reduction efforts and the economic ramifications of the energy transition[51].
6. **Balancing Climate Action and Biodiversity Conservation**: Concentrating primarily on climate change mitigation may unintentionally harm biodiversity. The United Nations warns against such an approach, instead advocating for comprehensive solutions that address numerous environmental concerns at the same time, ensuring that climate policies do not jeopardize natural habitats and biodiversity[52].

[50] https://en.wikipedia.org/wiki/Water%2C_energy_and_food_security_nexus?utm_source=chatgpt.com
[51] https://time.com/7178427/climate-trade-policy-baku-cop29/?utm_source=chatgpt.com
[52] https://www.thetimes.co.uk/article/dont-focus-on-climate-action-at-expense-of-nature-says-un-bwzln7lj8?utm_source=chatgpt.com

# General Recommendations for Flood Risk Management

1. **IDP Site Management**:
   - ❖ Relocate high-risk **IDP** sites to safer places with lower flood risk.
   - ❖ Offer flood-resistant shelters for **IDPs** in medium-risk areas.
2. **Infrastructure Resilience:**
   - ❖ Build flood defenses, such as embankments, around essential infrastructure and metropolitan areas.
   - ❖ Improve drainage systems to prevent water collection in high-risk areas.
3. **Agricultural Adaptation:**
   - ❖ Promote flood-resistant crops in flood-prone agricultural areas.
   - ❖ Implement soil conservation practices to reduce erosion.
4. **Early Warning Systems:**
   - ❖ Create flood **early warning systems** to alert communities and **IDPs** of approaching flood hazards.
   - ❖ Carry out regular flood hazard assessments and update maps to reflect changing threats.
5. **Community-Based Disaster Preparedness:**
   - ❖ Teach local communities about flood risk mitigation, emergency response, and evacuation protocols.
   - ❖ Make sure **IDPs** are included in catastrophe preparedness planning.
6. **Environmental Protection:**
   - ❖ Reforest erosion-prone regions to help stabilize soils and lessen flood damage.

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# List of Acronyms

| | |
|---|---|
| AI | – Artificial Intelligence |
| BBC | – British Broadcasting Corporation |
| BMZ | – Federal Ministry for Economic Cooperation and Development |
| CBOs | – Community-Based Organizations |
| CARE | – Cooperative for Assistance and Relief Everywhere |
| CSOs | – Civil Society Organizations |
| EPA | – Environmental Protection Authority |
| ESA | – European Space Agency (Europe) |
| EU | – European Union |
| EWS | – Early Warning Systems |
| FAO | – Food and Agriculture Organization of the United Nations |
| FEMA | – US Federal Emergency Management Agency |
| GCF | – Green Climate Fund |
| GHG | – Greenhouse Gas |
| GIS | – Geographic Information Systems |
| GPM | – Global Precipitation Measurement |
| HDP | – Humanitarian-Development-Peace |
| HEC-RAS | – Hydrologic Engineering Center - River Analysis System |
| HRP | – Humanitarian Response Plan |
| ICRC | – International Committee of the Red Cross |
| IDP | – Internally Displaced Person |
| IDPs | – Internally Displaced Persons |
| ILO | – International Labour Organization |
| IOM | – International Organization for Migration |
| IoT | – Internet of Things |
| KPIs | – Key Performance Indicators |
| MAI | – Ministry of Agriculture and Irrigation |
| M&E | – Monitoring and Evaluation |
| MEL | – Monitoring, Evaluation, and Learning Systems |
| MWE | – Ministry of Water and Environment |
| NAPA | – National Adaptation Program of Action |
| NASA | – National Aeronautics and Space Administration (United States) |
| NGOs | – Non-Governmental Organizations |

**(Cont.)**

| | |
|---|---|
| NWRA | – National Water Resources Authority |
| OCHA | – United Nations Office for the Coordination of Humanitarian Affairs |
| OECD-DAC | – Organization for Economic Co-operation and Development - Development Assistance Committee |
| PDA | – Peace and Development Association |
| PPPs | – Public-Private Partnerships |
| ROY | – Republic of Yemen |
| RS | – Remote Sensing |
| SDGs | – Sustainable Development Goals |
| ToT | – Training of Trainers |
| UN | – United Nations |
| UNDP | – United Nations Development Program |
| UNEP | – United Nations Environment Program |
| UNFCCC | – United Nations Framework Convention on Climate Change |
| UNICEF | – United Nations International Children's Emergency Fund |
| USAID | – United States Agency for International Development |
| US or USA | – United States of America |
| WB | – World Bank |
| WFP | – World Food Program |
| WHO | – World Health Organization |
| WMO | – World Meteorological Organization |
| WWF | – World Wide Fund for Nature |
| YCCI | – Yemen Climate Change Initiative |
| YHF | – Yemen Humanitarian Fund |
| YNI | – Yemen Nexus Initiative |

# Executive Summary

**Yemen's** landscape is dominated by arid and semi-arid conditions, with significant geographical variation across its five ecological zones: coastal plains, temperate highlands, high plateaus, desert interiors, and the islands' archipelago. The country experiences a monsoon-influenced climate, with distinct rainy and dry seasons that vary regionally.

**Climate change** is compounding these challenges, with increasing extreme weather events such as floods, droughts, and storms exacerbating displacement and environmental degradation. **IDP** camps, in particular, are highly vulnerable, with **45%** of sites at risk of flooding, leading to frequent secondary displacement.

The country has two main rainy seasons: Saif (April-May) and Kharif (July-September), with significant rainfall variations across regions. Recent extreme weather events, such as the July floods, have severely impacted western **governorates** like **Al-Hodeidah**, **Hajjah**, and **Taiz**, displacing thousands and damaging infrastructure.

**Yemen** lies at the crossroads of **climate change**, **humanitarian** crises, **development** challenges, and **peacebuilding** efforts. Consequently, **Yemen** is confronting one of the world's most acute **humanitarian** crises, with approximately **20.7 million** people in need of assistance and **4.3 million** internally **displaced people (IDPs)** as of **2021**.

With rising temperatures, more frequent droughts, water scarcity, and extreme weather events, the country is facing an accelerating crisis that threatens food security, displaces populations, and exacerbates resource-driven conflict. Addressing these difficulties requires a comprehensive and coordinated strategy that incorporates climate adaptation into **humanitarian**, **development**, and **peacebuilding (HDP) initiatives**, often known as the Nexus method.

While **humanitarian** aid remains the dominant focus for many organizations, followed closely by **development** and **peacebuilding** efforts, weak coordination across these

sectors limits the effectiveness of long-term resilience-building initiatives. **Climate change** is recognized as a major driver of displacement and conflict, yet only half of the organizations actively address it through adaptation strategies such as climate-smart agriculture, water management, and disaster risk reduction. Despite the urgent need for climate resilience, only a small fraction of organizations systematically measures the impact of their programs, highlighting a significant gap in monitoring and evaluation efforts. Additionally, financial constraints remain the most significant challenge, with the majority citing financing shortfalls as a barrier to long-term adaptation and resilience-building.

For the **Nexus approach** to deliver sustainable impact, organizations and policymakers must focus on stronger coordination, innovative funding mechanisms, and local capacity-building. Enhancing cross-sector collaboration through joint coordination platforms and improved data-sharing can increase efficiency and impact. Securing sustainable climate financing requires shifting from short-term emergency relief to multi-year resilience-building initiatives while promoting **public-private partnerships (PPPs)** for climate adaptation investments. Strengthening local adaptation strategies by supporting community-led climate initiatives and training programs will equip local institutions with the tools needed for climate-resilient policies. Furthermore, improving climate data collection and monitoring through **GIS**, **remote sensing**, and standardized impact assessment frameworks will help measure progress and ensure accountability.

To assess the **Nexus of climate change impacts on water, energy, and food security**, six key governorates have been identified based on their diverse geographical and socio-economic characteristics:

1. **Hadramout** – Faces severe water scarcity and agricultural sustainability challenges.
2. **Marib** – Historically significant for water management, with modern-day water resource vulnerabilities.
3. **Aden** – A coastal urban hub facing risks from sea-level rise, flooding, and freshwater salinization.

4. **Al-Hodeidah** – A major agricultural region affected by rising temperatures and water insecurity.
5. **Hajjah** – Experiences seasonal flooding and landslides, exacerbating humanitarian concerns.
6. **Taiz** – A densely populated conflict-affected area where **climate change** worsens water and food insecurity.

As **Yemen** continues to struggle with both environmental and **humanitarian** crises, **integrated climate adaptation and resilience strategies** are critical to mitigating the worsening impacts on communities and infrastructure.

# Preface

This paper is divided into three sections, each addressing an important component of **climate change** and the **Nexus** strategy in **Yemen**. It intends to give a complete overview of the country's environmental concerns while also investigating potential responses that combine water, energy, and food security.

**Part One:** establishes the groundwork for the study by explaining the **Nexus** idea and its application to **Yemen's** distinct socio-environmental landscape. This section focuses on the theoretical framework and background required to understand how interconnected systems work in addressing resource management concerns.

**Part two:** examines the effects of **climate change** in six **governorates**: **Hadramout**, **Marib**, **Aden**, **Al-Hodeidah**, **Hajjah**, and **Taiz**. It investigates how **climate change** influences water availability, food production, and energy access in these areas. This section also looks at **Nexus**-based actions that can help to reduce climate risks and increase resilience.

**Part three:** offers' findings from an online questionnaire study of **Yemeni** local groups. This section examines major findings from stakeholders involved in climate adaptation and resource management, providing a localized perspective on the viability and efficacy of **Nexus**-based approaches. This section finishes with major suggestions that outline concrete solutions for improving **climate resilience** and sustainable resource management in **Yemen**.

The present study aims to add to **Yemen's** continuing discourse on **climate resilience** and sustainable development. By combining empirical findings with stakeholder viewpoints, we would like to advise policies and initiatives that solve the country's pressing environmental and **humanitarian** concerns.

We extend our gratitude to all contributors that participate the online questionnaire. Their valuable insights and cooperation have been instrumental in shaping this study.

# Part IV
# Statistical Analysis

# Assessment of Stakeholder Responses: Questionnaire and Interview Analysis

## I. Assessing Humanitarian Perspectives

### Background

Understanding **humanitarian** stakeholders' viewpoints is critical for improving aid program efficacy and ensuring that **humanitarian** operations are customized for the needs of affected people. **Humanitarian** work takes place in complicated situations, necessitating coordination among a variety of actors, including **NGOs**, **international organizations**, **local governments**, and affected **populations**. By evaluating different views, we can discover gaps, improve coordination, and devise solutions to promote long-term resilience, sustainability, and peace.

### Questionnaire Framework: Scope and Purpose

The successful implementation of the **Humanitarian-Development-Peace (HDP) Nexus** paradigm in **Yemen** necessitates a thorough grasp of **humanitarian** stakeholders' perspectives and experiences. As a result, an online questionnaire was developed using the **KOBO** tools and used to conduct interviews with a variety of **humanitarian** stakeholders. The questionnaire form was created to address the need to understand the strategy underlying **humanitarian** operations and initiatives in **Yemen**, specifically. Furthermore, the questionnaire seeks valuable feedback to improve the efficacy of **Nexus** initiatives by concentrating on essential areas such as **humanitarian** assistance, **development**, **peacebuilding**, coordination, and the challenges and opportunities that exist.

Given the growing impact of **climate change** in **Yemen**, this questionnaire will also look into how climate-related difficulties affect **Nexus** programming and how organizations incorporate climate resilience into their **humanitarian**, **development**, and **peacebuilding** activities. By identifying gaps, best practices, and areas for improvement, the responses gathered will help to strengthen coordination and generate more sustainable and impactful actions in **Yemen**.

Based on the foregoing considerations, the questionnaire was designed to address the first element of the **humanitarian component**, while the second half addresses the impact of **climate change** on the **Yemeni** environment, as well as aid and solutions (**see Appendix A**).

## Limitations: Obstacles and Challenges

Due to great distances, difficulty in travel, and a severe shortage of time, a field survey and face-to-face interviews with **humanitarian** workers were not possible. As a result, this questionnaire was created and made available online to speed up the collecting of primary data on **humanitarian** and climatic issues, which was then analyzed using **MS Excel** software. The extracted preliminary information will provide a clear picture of the **Nexus Humanitarian-Development-Peace (HDP)** approach taken on the ground in regard to **Yemen's** complex circumstances, as well as the natural disasters that occur on a regular basis, causing widespread devastation and suffering, particularly among the displaced people.

## Questionnaire Data Analysis & Findings

The online survey received replies from about ten stakeholders representing diverse groups operating in southern **Yemen**. These stakeholders included representatives from the **humanitarian**, **development**, and **peacebuilding** sectors, who shared views regarding the region's difficulties, levels of coordination, and intervention effectiveness. The poll sought to examine the level of coordination among various sectors, the viability of ongoing projects, and the extent to which local communities participate in **humanitarian** operations. The findings reveal a wide range of

viewpoints, with various degrees of satisfaction with intersectoral collaboration, resilience-building techniques, and the overall impact of aid operations. The responses provide useful information for future strategies to improve **humanitarian** and **development** activities in **Yemen**.

## Questionnaire Content

The questionnaire was divided into two portions, each focusing on crucial components of **Yemen's** **humanitarian**, **development**, and **peacebuilding** (**HDP**) operations. **Part I:** The **Nexus Approach** in **Yemen** emphasized the combination of **humanitarian** assistance, **development** programming, and **peacebuilding** activities. It investigated coordination mechanisms, the problems and opportunities associated with aligning various sectors, and the efficacy of monitoring and evaluation frameworks. Additionally, an open comment section encouraged respondents to submit ideas for refining the **HDP Nexus method**.

**Part II: Climate Change Impacts** using a **Nexus Approach** in **Yemen** investigated the relationship between **climate change** and **HDP** efforts, emphasizing the consequences on vulnerable groups. It evaluated adaptation options, difficulties to tackling **climate change** within the **HDP** framework, and stakeholder coordination efforts. It, like the first component, includes monitoring and evaluation of climate-focused programs, as well as an open feedback section to solicit proposals for improving climate resilience using the **Nexus** method.

The questionnaire provided an in-depth investigation of **Yemen's** **humanitarian** and **development** scenario, incorporating viewpoints on both crisis response and long-term sustainability, particularly in light of climate-related difficulties (see **Appendix A**).

## Participants' Responses to the Questionnaire

**11 local organizations** responded to the questionnaire. The majority of poll participants work in **humanitarian** relief, **development** and **peacebuilding**. The following paragraph describes the contents of the questionnaire collected from some of **Yemen's** **local organizations**.

## 1. Key Sector Areas Working in Yemen

The pie chart (Fig. 1) depicts the proportion of **HDP** (**Humanitarian**, **Development**, and **Peacebuilding**) activities in Yemen, highlighting the distribution of resources across sectors. **Humanitarian** actions make for the greatest portion, **31%**, highlighting the critical need for rapid relief and life-saving initiatives. Development activities follow closely at **31%**, emphasizing the importance of long-term economic and social stability. **Peacebuilding** initiatives account for **27%**, highlighting the importance of promoting regional stability and conflict resolution. Finally, **11%** of activities fall into the "**Others**" category, which could include cross-sector efforts or specialized programs. The reasonably fair distribution of **humanitarian**, **development**, and **peacebuilding** initiatives indicates a multifaceted strategy to Yemen's crisis, enabling both urgent relief and long-term rehabilitation efforts. However, the slightly smaller share of **peacebuilding** efforts could imply difficulties in conflict resolution and governance changes.

The bar chart (Fig. 2) depicts the distribution of organizational operations across Yemen, categorizing them as **humanitarian**, **development**, **peacebuilding**, and others.

### Key Observations:

- **Balanced Distribution of Activities** - Most organizations are involved in a combination of **humanitarian**, **development**, and **peacebuilding** operations, demonstrating a multi-sectoral approach to tackling Yemen's issue.
- **Prominent Organizations** - The **Peace and Development Association (PDA)** has the most operations, notably in **peacebuilding** and **humanitarian** efforts, indicating a significant emphasis on stability and quick help.

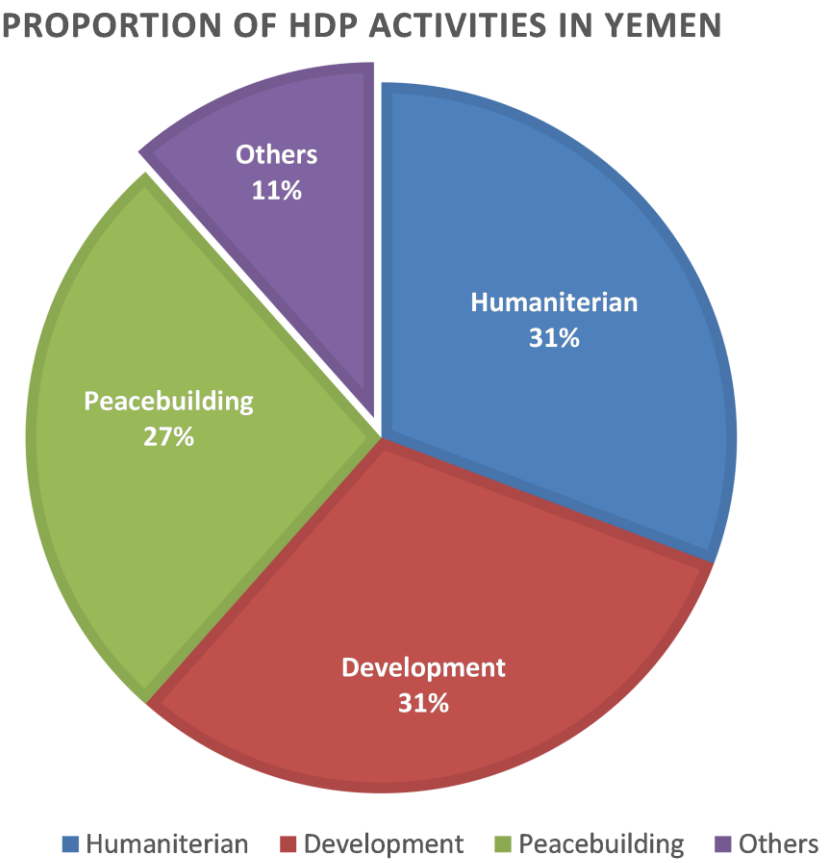


Fig. 1: Statistical pie form depicts the proportion of HDP activities in Yemen (Source: **the author**).

- **Humanitarian and Development Focus** - Organizations such as the **Creativity Association for Women's Development**, **Al-Kristalah Women's Development Association**, and **Bard Al-Ataa Humanitarian Development Association** place nearly equal emphasis on **humanitarian** and **development** initiatives, emphasizing the need to integrate relief efforts with long-term growth plans.
- **Variability in Peacebuilding Contributions** - Some groups, such as the **Watan Foundation for Development and Training** and the **Deem Organization for Development**, have a strong emphasis on **peacebuilding**, while others, such as the **Yemeni Women's Union Marib**, focus exclusively on **humanitarian** assistance.

- **Limited presence in the 'Others' category**. A few organizations, such as the **Correction Foundation,** focus only on activities classed as "Others," which may represent specialized interventions that do not fit into the three main categories.

In conclusion, the distribution of organizational functions (**Figs. 3** & **4**) indicates a comprehensive strategy to resolving **Yemen's** difficulties, with a significant emphasis on **humanitarian** and **development** efforts. **Peacebuilding** activities, while prevalent, tend to be less prominent in some organizations, indicating difficulty in maintaining long-term stability and conflict resolution. Improving coordination among these sectors may increase the overall impact of aid and **development** activities.

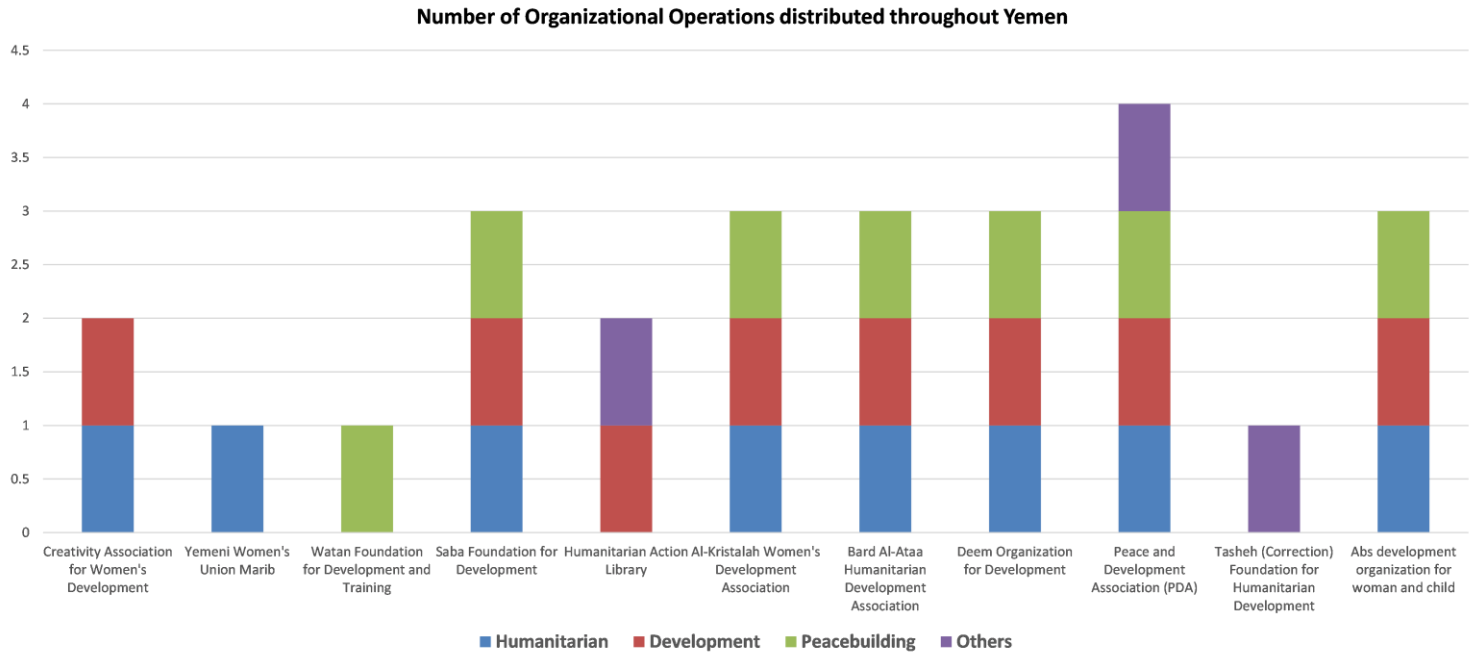


**Fig. 2**: A bar chart displays various local organizations working in the **Southern** part of **Yemen**. (Source: **the author**).

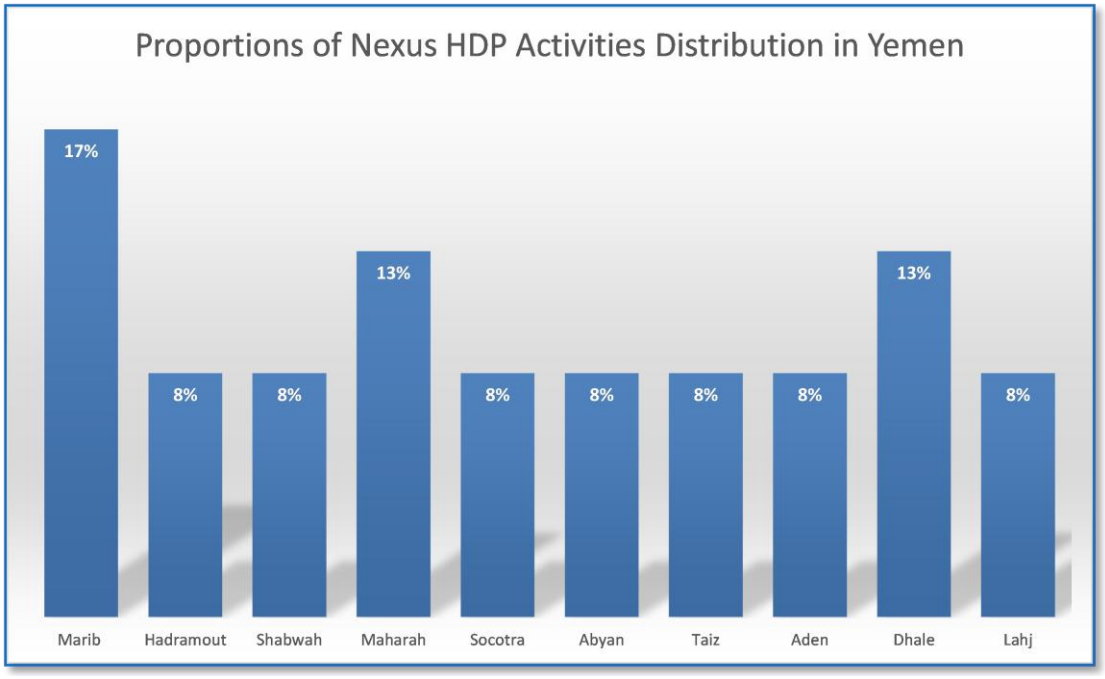


**Fig. 3**: A bar chart depicts the **Nexus HDP** activity spread throughout **Yemen**.

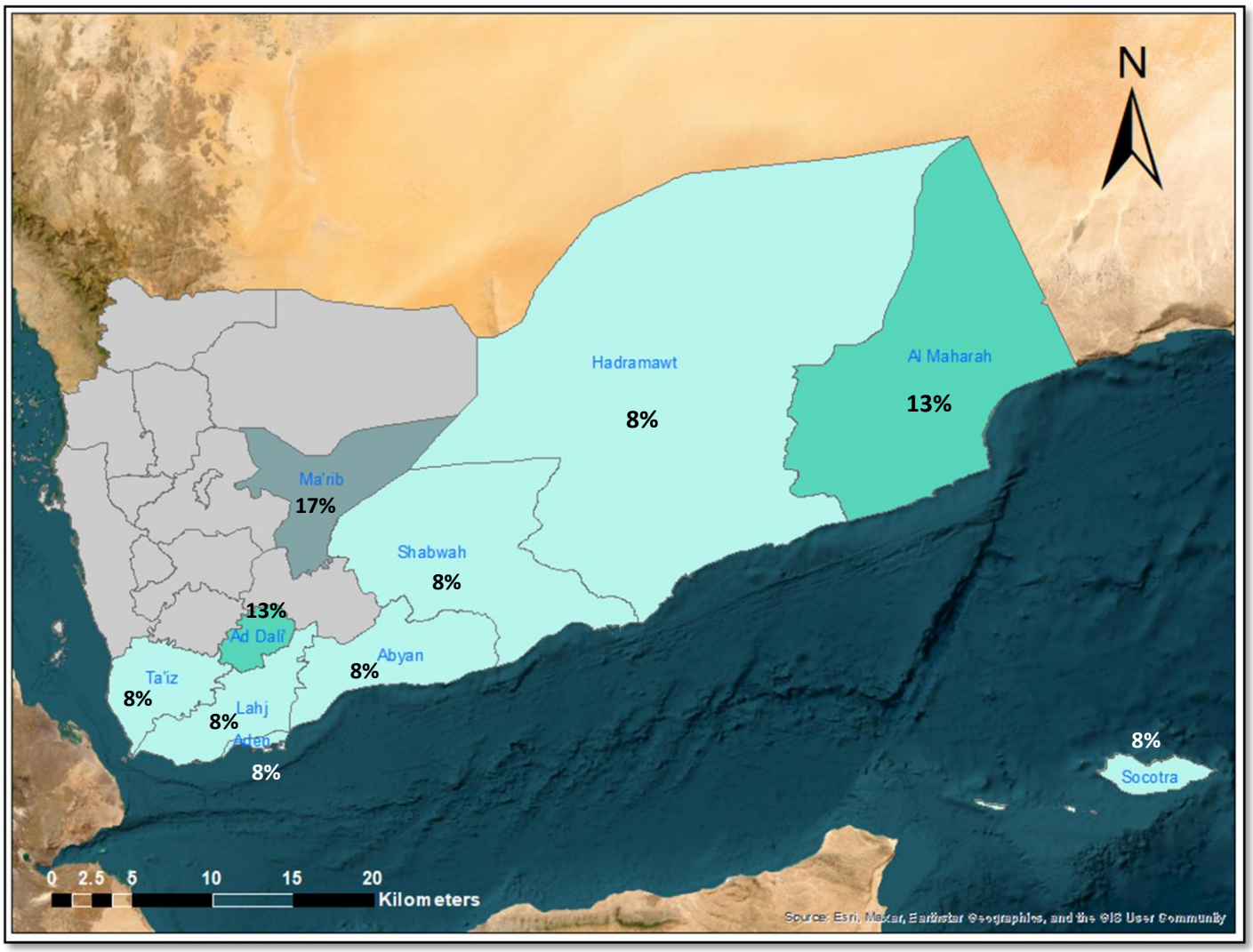


**Fig. 4**: Geographic distribution of several organizations and their percentage of operations in **Southern Yemen**. (Source: **the author**).

## 2. Key Humanitarian Challenges Facing Organizations in Yemen

Yemen has been facing one of the world's most severe **humanitarian** crises, driven by ongoing conflict, economic instability, and environmental challenges. The situation has led to widespread food insecurity, a collapsed healthcare system, mass displacement, and deteriorating infrastructure[1]. Addressing these challenges requires a comprehensive approach that not only provides immediate relief but also aligns **humanitarian** interventions with long-term stability and **development** goals[2]. Implementing sustainable programs that enhance community resilience is essential in ensuring lasting impact, particularly in sectors such as agriculture, healthcare, and education[3]. Additionally, active involvement of local communities in designing and executing **humanitarian** projects fosters relevance, efficiency, and long-term success[4]. By integrating short-term aid with sustainable strategies and community participation, humanitarian efforts in Yemen can move beyond crisis response to support long-term recovery and resilience.

The challenges faced by **humanitarian** organizations in Yemen can be grouped into four main categories:

### 1. Financial and Funding Challenges

- **Fund problems**
- **Lack of sustainable funding (mentioned twice)**
- **Building trust with donors**
- **Operational sustainability**

[1] UN OCHA, 2023
[2] World Bank, 202
[3] FAO, 2021
[4] IFRC, 2022

Many organizations face intermittent or insufficient funding, making it difficult to sustain long-term initiatives. Donor trust is critical, since organizations must demonstrate transparency and accountability to secure long-term financial support.

## 2. Structural and Administrative Barriers

- **Project and marketing study is not adequate**
- **Weak technical and administrative capacities**
- **Lack of transparency in resource allocation**
- **Bureaucratic barriers**

Organizations encounter internal and external administrative hurdles, including limited technical skills, ineffective planning, and bureaucratic obstacles that slow down aid delivery. Addressing these issues needs capacity-building efforts and enhanced governance structures.

## 3. Accessibility and Operational Challenges

- **Access to remote areas**
- **Competition with international organizations**
- **Local skills shortage**

Delivering aid to remote and conflict-affected areas is a major challenge due to security concerns, a lack of infrastructure, and logistical constraints. Additionally, international organizations frequently dominate the aid landscape, making it difficult for local **NGOs** to compete for funding and resources. Shortages of skilled local workers further impede effective program implementation.

## 4. Conflict and Societal Factors

- **Impact of armed conflict**
- **Cultural and societal challenges**

The continuous armed conflict greatly hampers **humanitarian** work, posing security hazards, displacing people, and creating instability. Furthermore, cultural and societal conventions might provide difficulties, especially for organizations working on sensitive themes like women's empowerment and human rights. **Yemen's humanitarian** sector is facing a complex mix of difficulties that necessitate deliberate solutions and increased stakeholder coordination. Addressing financing shortfalls, building local capacity, boosting transparency, and strengthening coordination between local and international groups are all crucial to ensuring an effective and long-term **humanitarian** response. Additionally, understanding conflict dynamics and cultural sensitivities is critical for optimizing impact and promoting long-term stability in **Yemen**.

## 3. The Level of Cooperation Among the Humanitarian, Development, and Peacebuilding Sectors in Yemen

The level of coordination between the **humanitarian**, **development**, and **peacebuilding** sectors in **Yemen** is mixed (**Fig. 5**). According to the results, **30%** of participants assessed the coordination as very good, showing that efforts are aligned in some areas, allowing for effective intervention and resource allocation. However, an equal **30%** rated the coordination as moderate, indicating that while some collaboration exists, there are still obstacles in properly integrating **humanitarian** help with long-term **development** and **peace** activities. Furthermore, another **30%** assessed coordination as poor, indicating major gaps, which could be due to fragmented activities, a lack of communication, or competing agendas among groups. The remaining **10%** of replies were diverse, which could represent sector-specific disparities or particular issues faced by specific stakeholders. Overall, these findings indicate that, while there are some encouraging examples of cooperation, significant efforts are still required to guarantee a more unified and coordinated approach across all sectors in **Yemen**.

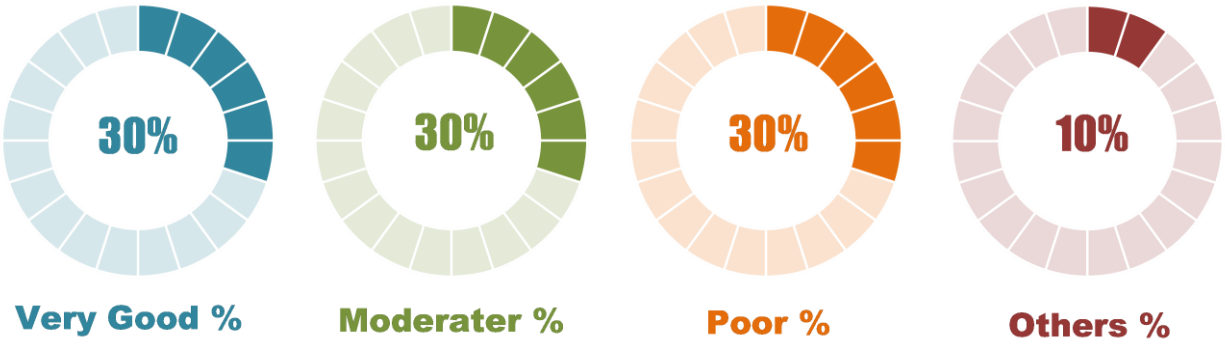


Fig. 5: level of coordination between the **humanitarian**, **development** and **peacebuilding** sectors in Yemen, (Source: **the author**).

## 4. Aligning interventions for humanity with long-term development objectives.

Based on questionnaire responses, this section highlights many important problems and approaches to merging **humanitarian** operations with long-term **development** goals. These can be divided into four major categories:

**1. Lack of Long-Term Development Planning**

- Many organizations have **not fully implemented long-term development goals**.
- There is a need to **balance urgent humanitarian aid with sustainable development**.
- **Adapting interventions to the pace of changing needs** is essential but challenging.

**Significant Realization**: ***Organizations should look beyond emergency relief and incorporate sustainability and development frameworks into their plans.***

**2. Community-Centered and Needs-Based Approaches**

- Interventions must be **based on field assessments and local needs**.
- **Community participation** and the role of local authorities are crucial.

- **Empowering local communities** through training, education, and capacity-building enhances self-reliance.

**Significant Realization**: ***Local engagement ensures that programs are relevant and sustainable, decreasing reliance on external aid.***

**3. Financial and Resource Limitations**

- There is a need for **sustainable funding models** to ensure long-term impact.
- Organizations like **Bard Al-Ataa** and **Deem** focus on **income-generating projects**, such as the **prison bakery initiative**, to support self-sufficiency.

**Significant Realization: *Investing in productive and livelihood projects can help communities become self-sufficient and reduce their need on humanitarian aid.***

**4. Collaboration, Monitoring, and Strategic Planning**

- **Joint planning with stakeholders** (**government**, **NGOs**, **private sector**) enhances coordination.
- **Monitoring and evaluation mechanisms** ensure interventions are effective.
- **Strategic partnerships** provide expertise, funding, and long-term sustainability.

**Significant Realization: *Improving cross-sector collaboration can boost the efficacy of humanitarian and development activities.***

## 5. Building Resilient and Sustainable Humanitarian Programs in Yemen

The responses can be grouped into three main categories based on the level of sustainability integration:

**1. No Sustainability Integration**

- Some organizations responded with a direct "**No**" indicating that their programs do not currently focus on resilience and sustainability. This suggests a gap in long-term planning and a potential reliance on short-term relief efforts.

**2. Partial Sustainability Efforts**

- Some organizations have implemented programs that include sustainability, though not always in a methodical fashion. Examples include income training and family aid programs to improve lives, the installation of a sustainable bakery for inmates, and the construction of a primary school with extension possibilities, all of which represent future development planning.

**3. Comprehensive Resilience and Sustainability Approaches**

- Several organizations have incorporated sustainability into various areas of their **humanitarian** initiatives, indicating a long-term strategic vision. Examples include sustainable agriculture initiatives that give improved seeds and promote contemporary farming techniques, renewable energy solutions such as solar power installations in distant areas, and vocational training for youth and women to promote economic independence. Furthermore, infrastructure improvement in water, sanitation, and education provides long-term advantages beyond emergency relief efforts, while food security measures help local agricultural productivity and supply linkages. **Peacebuilding** and social integration programs strengthen communities and lay the groundwork for long-term growth.

## Commentary on the findings

The responses demonstrate a different approach to resilience and sustainability in **humanitarian** programs. While some groups remain focused on short-term relief, others have made major attempts to incorporate long-term **development** into their operations. However, there is a clear need to increase systematic sustainability initiatives, particularly in businesses that have yet to implement such methods. Strengthening coordination, increasing funding for long-term projects, and using best

practices in sustainable **development** can all assist to improve the overall impact of **humanitarian** aid in **Yemen**.

## 6. Local Community Participation in Humanitarian Projects for Infrastructure Repair in Yemen.

### Local community involvement in the design and execution of humanitarian projects

The good response to local community participation in **humanitarian** infrastructure repair projects in **Yemen** demonstrates that community engagement is increasingly recognized as a critical ingredient in project success. When **local** communities actively participate in the design and implementation of these programs, the projects are more effective, sustainable, and responsive to actual needs. This participation promotes a sense of ownership, builds confidence between organizations and beneficiaries, and ensures that treatments are culturally and contextually appropriate. To optimize impact, continuing collaboration, capacity building, and participatory decision-making processes should be improved, empowering communities to shape their own recovery and growth.

### Contributing rebuilds the infrastructure in Yemen

The results show that different organizations in **Yemen** are involved in infrastructure rebuilding to differing degrees. Some groups do not participate in infrastructure projects, while others prioritize them and include them into their **humanitarian** operations. Several groups work on school renovations, healthcare facility upgrades, water and sanitation initiatives, and renewable energy solutions. Furthermore, community participation is stressed as a critical component in achieving sustainability and resilience. Awareness initiatives are also being implemented to promote the long-term upkeep and sustainability of these infrastructural **developments**.

### Commentary

Several **humanitarian** groups' commitment to reconstructing important infrastructure in **Yemen** is critical to improving living conditions and promoting long-term **development**. Projects like school restoration, healthcare facility renovation, and clean water efforts not only meet immediate needs, but also improve community resilience and sustainability. The combination of renewable energy and capacity-building efforts boosts these approaches. However, the lack of cooperation from some organizations suggests that greater coordination and budget allocation are required to achieve broader and more sustainable infrastructure **development** throughout **Yemen**.

## 7. How to connect development projects and existing humanitarian activities?

The answers demonstrate a comprehensive and integrated strategy to **humanitarian** and **development** activities in **Yemen**. To achieve long-term sustainability, organizations prioritize community needs, collaboration with authorities, and specialized project implementation. The initiatives can be organized into important areas:

- **Sustainable Livelihoods and Economic Empowerment** - Training programs in handicrafts, small business management, and vocational skills assist youth and women in achieving economic independence.
- **Renewable Energy and Infrastructure Development** - Solar energy solutions, water network rehabilitation, and education and healthcare facility improvements all help to assure long-term service continuity.
- **Agriculture and Food Security** - Supporting local farmers, organic farming techniques, food banks, and climate-smart agriculture improves food sustainability.
- **Disaster Preparedness and Community Resilience** - Training communities in natural disaster preparedness, resource management, and self-sufficiency improves their ability to resist disasters.

- **Collaboration and Coordination** - Working with **local governments**, **NGOs**, and **international organizations** promotes coordinated efforts and maximum impact.

### Commentary

The **humanitarian** response in **Yemen** is shifting from short-term aid to long-term resilience and sustainability. Organizations are integrating emergency aid and **development** initiatives to ensure that interventions result in self-sufficiency rather than dependency. The emphasis on capacity building, sustainable infrastructure, and food security reflects a desire to empower people and promote stability. However, improved stakeholder coordination and resource allocation are required to ensure widespread and long-term **development** throughout **Yemen**.

## 8. Supporting peacebuilding initiatives in Yemen

**Humanitarian** operations in **Yemen** are increasingly focusing on sustainability and resilience through strategic programs that target long-term impact rather than immediate assistance. The key focus areas include economic empowerment and livelihoods, infrastructural **development**, food security and agriculture, disaster preparedness and resilience, and coordination and strategic partnerships.

In terms of economic empowerment, organizations provide training programs for young people and women in handicrafts, small companies, and vocational education. They also encourage business and resource management to foster self-sufficiency. These measures serve to strengthen local capabilities and promote long-term economic stability.

**Humanitarian** initiatives to develop infrastructure include the rehabilitation of schools, health facilities, and water networks, all of which are vital to community rebuilding. In addition, renewable energy solutions such as solar-powered schools and healthcare institutions are being implemented to assure long-term, sustainable energy access.

**Humanitarian** actors help local farmers with food security and agriculture by training them in organic farming and water-efficient irrigation techniques. They are also

building food banks and advocating for climate-smart agriculture methods to promote food security and resilience in the face of **climate change**[5].

Disaster preparedness initiatives aim to train communities in natural disaster preparedness, improving their ability to respond to calamities. Furthermore, efforts to improve water and sanitation infrastructure seek to promote long-term public health and reduce the impact of future calamities.

Effective coordination and strategic alliances are required to ensure that aid is distributed efficiently and effectively. **Humanitarian organizations** collaborate closely with **local governments**, **non-governmental organizations (NGOs)**, and **international organizations** to create integrated, long-term relief efforts that go beyond short-term aid.

The ongoing violence, economic challenges, and environmental vulnerabilities in **Yemen** shape the prioritization of **humanitarian** efforts. Food security is the top priority due to widespread starvation, with the **WFP** requiring **$1.5 billion** by **2025**[6]. Economic empowerment is also critical, given high unemployment and poverty, although funding figures remain unclear. Disaster preparedness follows, with the **UN** allocating **$20 million** for assistance[7]. Infrastructure development is vital for long-term recovery, with the **EU** contributing **€125 million** in aid[8]. Lastly, coordination and strategic partnerships receive less attention, with **OCHA** stressing the need for increased funding[9].

While progress is being made, obstacles such as limited finance, coordination issues, and inaccessibility to rural locations remain. These issues necessitate greater collaboration and capacity building to improve the long-term impact and durability of **humanitarian** initiatives in **Yemen**.

5 alsahwa-yemen.net

6 alsahwa-yemen.net
7 Reuters.com
8 civil-protection-humanitarian-aid.ec.europa.eu
9 yemenmonitor.com

In summary, the prioritization of **humanitarian** interventions in **Yemen** is shaped by the country's ongoing conflict, economic challenges, and environmental factors. **Humanitarian** organizations are focusing on sustainability and resilience through various strategic interventions.

These activities were prioritized based on their relevance and the information given by entities and organizations involved in similar projects in **Yemen**. The projected percentage allocations for **humanitarian** activities in **Yemen** are based on existing funding data and critical needs outlined in various studies. Here's a breakdown of the allocations as follows:

1. **Food Security – 40%**
    - **Funding**: The **World Food Program (WFP)** received approximately **$621.6 million**, accounting for **28%** of total funding in **2024**[10].
    - **Justification**: Given the severity of hunger affecting millions in **Yemen**, food security remains the top priority.
2. **Economic Empowerment & Livelihoods – 20%**
    - **Funding**: The **U.S.** has provided over **$1.1 billion** in **humanitarian** aid to **Yemen** since **2019**, including support for economic recovery.
    - **Justification**: Addressing high unemployment and poverty is crucial for long-term stability, warranting significant investment[11].
3. **Disaster Preparedness & Resilience – 15%**
    - **Funding**: The **United Nations** has highlighted the need for increased resources to address acute and growing **humanitarian** needs in **Yemen**.
    - **Justification**: **Yemen's** vulnerability to natural disasters necessitates substantial investment in preparedness and resilience[12].

[10] fts.unocha.org
[11] state.gov
[12] unhcr.org

4. **Infrastructure Development – 15%**

    - **Funding**: In **2023**, the **Federal Ministry for Economic Cooperation and Development (BMZ)** committed a total of **163.7 million euros** in new funding for **Yemen**, including infrastructure projects.
    - **Justification**: Rebuilding essential infrastructure is vital for long-term recovery and development[13].

5. **Coordination & Strategic Partnerships – 10%**

    - **Funding**: The **UN Office** for the Coordination of **Humanitarian Affairs (OCHA)** emphasizes the need for increased funding to support coordination efforts in **Yemen**[14].
    - **Justification**: Effective coordination among **humanitarian** actors is essential for efficient aid delivery, though it often receives less focus.

These allocations are derived from funding data and the critical importance of each sector in addressing **Yemen's humanitarian** crisis. It's important to note that actual funding levels can fluctuate based on evolving circumstances and donor commitments.

## 9. Addressing local conflicts over resources such as water and land.

The questionnaire responses emphasize the fundamental issues and options associated with **Yemen's** resource conflicts, notably those regarding water and land (**Fig. 6**). Scarcity, mismanagement, and rivalry for these critical resources can cause community problems. To address these concerns, **humanitarian** groups and local stakeholders are launching awareness campaigns, mediation efforts, long-term resource management programs, capacity-building initiatives, and strategic alliances. These responses serve as the foundation for the analysis and comments presented,

[13] bmz.de
[14] gcc.unfpa.org

which focus on how different techniques contribute to dispute resolution, societal cohesiveness, and long-term sustainability. These efforts can be **grouped into five main categories**, each contributing to **peacebuilding** and resilience in **Yemen** as follows:

### 1. Community Engagement & Awareness

❖ **Key Strategies:**

- Involving **local authorities and community leaders** in conflict resolution.
- Organizing **awareness workshops** on sustainable resource management.
- Promoting **youth and women participation** in decision-making.

❖ **Challenges:**

- Resistance from **traditional leadership structures**.
- Need for **long-term behavioral change** in conflict-prone communities.

❖ **Commentary:**

- Awareness campaigns are **a critical first step**, but they must be **paired with concrete action plans** to yield lasting impact.

### 2. Conflict Mediation & Dialogue

❖ **Key Strategies:**

- **Mediating land and water disputes** through structured dialogue sessions.
- Establishing **community committees** to resolve conflicts independently.
- Organizing **open forums** where different groups can negotiate resource-sharing agreements.

❖ **Challenges:**

- **Ensuring neutrality** in mediation efforts.
- **Lack of enforcement** mechanisms for agreements.

❖ **Commentary:**

- Mediation is **effective in reducing immediate tensions**, but success depends on **strong enforcement mechanisms** and **continued dialogue**.

### 3. Sustainable Resource Management & Infrastructure Development

❖ **Key Strategies:**

- Implementing **modern irrigation techniques** to optimize water use.
- Constructing **water wells and repairing irrigation networks** to ease resource scarcity.
- Developing **community-based mechanisms for fair resource distribution**.

❖ **Challenges:**

- **High cost** of infrastructure projects.
- **Potential for mismanagement** without community ownership.

❖ **Commentary:**

- **Infrastructure development is essential** for reducing competition over resources, but projects must be **designed with long-term sustainability** in mind.

### 4. Capacity Building & Institutional Strengthening

❖ **Key Strategies:**

- Training **local committees** on conflict resolution and resource management.
- Strengthening **the rule of law** in resource governance.
- Establishing **volunteer groups** to support peace initiatives.

❖ **Challenges:**

- **Ensuring community buy-in** and long-term participation.
- **Limited government capacity** to enforce regulations.

❖ **Commentary:**

- **Empowering local structures is crucial**, but they must be given **legal and financial support** to function effectively.

### 5. Strategic Partnerships & Sustainability

❖ **Key Strategies:**

- Collaborating with **international and local organizations** for financial and technical support.
- Developing **sustainable development projects** that integrate humanitarian aid with economic growth.

❖ **Challenges:**

- **Dependence on external funding** for sustainability.
- **Coordination issues** between multiple stakeholders.

❖ **Commentary:**

- **Partnerships enhance resource availability**, but **local ownership** is necessary for long-term impact.

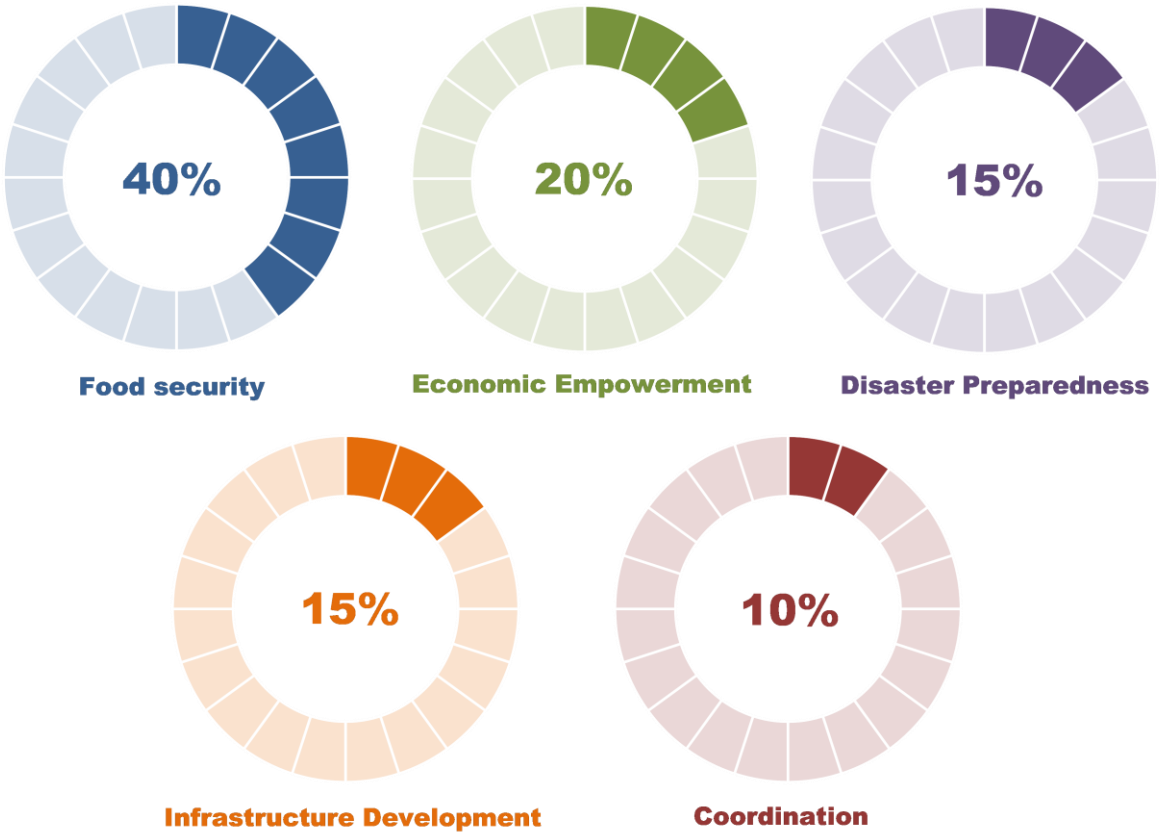


Fig. 6: The different humanitarian activity sectors in Yemen, (Source: **the author**).

### Final Thoughts

The initiatives demonstrate a **comprehensive approach** to conflict resolution by addressing both **immediate disputes** and **long-term resource sustainability**. However, **greater emphasis on enforcement, long-term sustainability, and institutional support** is needed to ensure these interventions **translate into lasting peace and stability** in **Yemen**.

## 10. Local and Stakeholder Participation in Peacebuilding & Coordination Among Humanitarian, Development, and Peacebuilding Sectors in Yemen

The majority (**90%**) of respondents believe local stakeholders are involved in **peacebuilding** efforts. However, the single "**No**" response may indicate gaps in participation, possibly in specific regions or sectors. More inclusive mechanisms may be needed to improve engagement (**Fig. 7**).

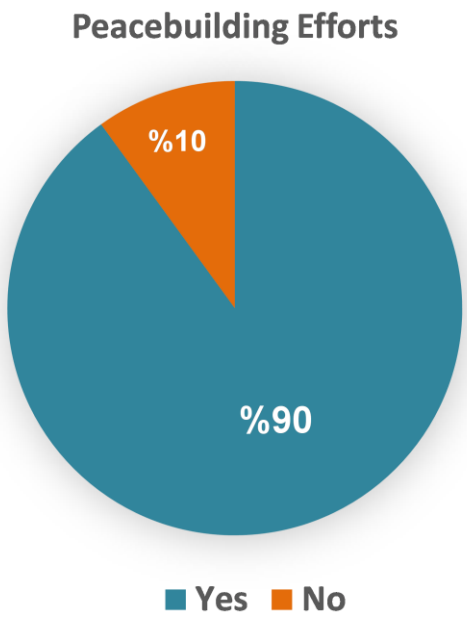


**Fig. 7**: The pie chart depicts the percentage of peacebuilding initiatives in **Yemen** (source: **the author**).

In Yemen, perceptions of coordination between the **humanitarian**, **development**, and **peacebuilding** sectors are varied (Fig. 8). While **30%** of respondents feel coordination is extremely effective, **40%** rank it as moderate, showing space for growth, and **30%** rate it as poor, highlighting considerable gaps. Positive perceptions (**30%**) indicate that some firms benefit from strong networks and structured collaborations. Moderate responses (**40%**) suggest limited success with discrepancies in communication and collaboration. Negative feedback (**30%**) indicates fragmentation, a lack of coherent policies, and competing interests across sectors. These variances indicate that cooperation is not consistent across regions and organizations. To improve collaboration, greater integration mechanisms are required, such as collaborative planning, shared data systems, and cross-sector meetings. Targeted efforts should concentrate on regions and sectors where coordination is weakest, resulting in a more unified and effective **humanitarian** and **development** response in Yemen.

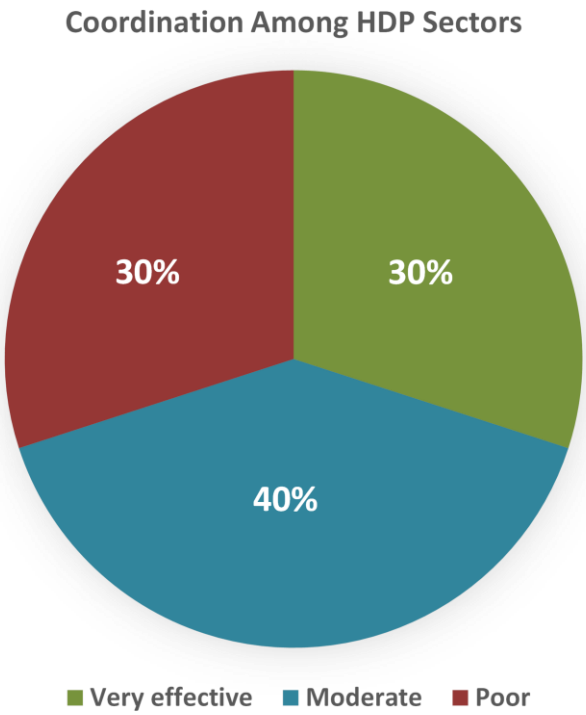


Fig. 8: The Pie chart illustrates the percentage of **coordination** among **HDP** in Yemen, (Source: **the author**).

Finally, while local participation in **peacebuilding** is high, coordination among **humanitarian**, **development**, and **peacebuilding** sectors remains inconsistent. Strengthening collaboration frameworks and ensuring equitable engagement across all actors will be key to enhancing the overall effectiveness of **peacebuilding** efforts in **Yemen**.

## 11. opportunities to improve the triple nexus programming in Yemen.

The **questionnaire** results (**Fig. 9**) show that, while local and stakeholder participation in peacebuilding is broadly accepted (**90%** favorable response), coordination across the **humanitarian**, **development**, and **peacebuilding** sectors is inconsistent. The data show that **30%** rank coordination as poor, **40%** as moderate, and **30%** as extremely good, highlighting both gains and gaps. Strengthening collaboration, organized alliances, and integrative mechanisms is critical to optimizing impact in **Yemen's Triple Nexus approach**.

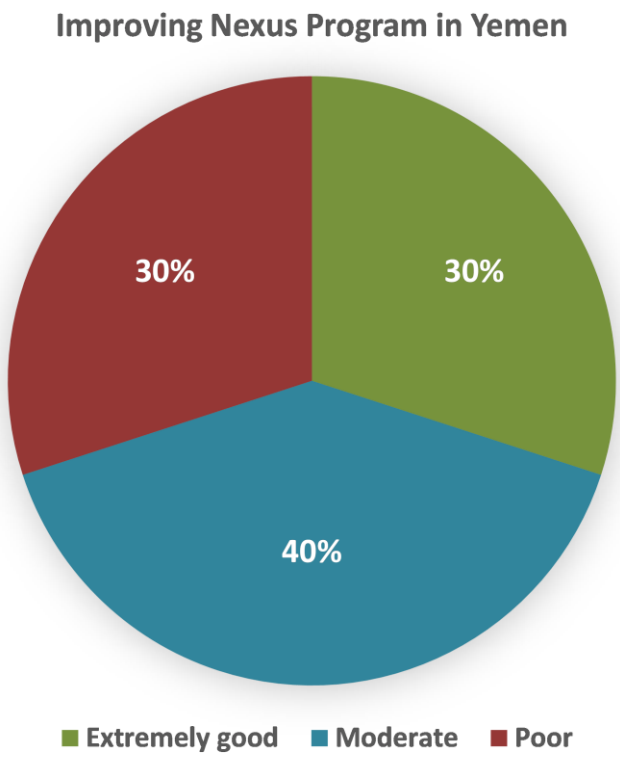


**Fig. 9**: The Pie chart illustrates the percentage of improving **Nexus** in **Yemen**, (Source: **the author**).

## Enhancing Triple Nexus Programming in Yemen: Key Opportunities

In light of the complex **humanitarian** and **development** situation in **Yemen**, there are many opportunities to enhance the triple **Nexus approach**, which integrates **humanitarian** assistance, **development**, and **peacebuilding**. These opportunities enable organizations such as the **Bard Al-Ataa Humanitarian Development Association** and the **Correction Foundation for Humanitarian Development** to achieve greater and more sustainable impacts. The following key areas highlight the main opportunities and strategies for advancing this approach:

### 1. Strengthening Institutional and Community Capacities

- **Building Institutional Capacities**: Strengthening local organizations and governance structures ensures sustainability in **humanitarian** and **development** efforts.
- **Community Engagement**: Local communities play a crucial role in identifying needs, implementing projects, and ensuring long-term success.
- **Education & Awareness**: Organizing training, workshops, and awareness campaigns can empower communities and enhance program effectiveness.

### 2. Promoting Partnerships and Coordination

- **Local & International Collaboration**: Strengthening cooperation between local and international **NGOs**, **UN** agencies, and **government** bodies can maximize impact.
- **Networking & Coordination**: Improved coordination among organizations helps streamline efforts, reduce duplication, and optimize resources.
- **Leveraging Global Interest in Yemen**: Increased **international** focus on **Yemen** can attract more funding and advocacy for **Nexus** programs.

### 3. Addressing Root Causes Through Sustainable Development

- **Infrastructure Development**: Investing in water, health, and education projects bridges emergency relief with long-term **development**.
- **Utilizing Natural Resources**: **Yemen's** agricultural and marine resources can be leveraged for sustainable livelihoods and food security.

- **Climate Resilience**: Programs addressing drought, floods, and environmental sustainability (e.g., irrigation, solar energy) align with global funding priorities.

### 4. Fostering Peacebuilding and Conflict Resolution

- **Local Mediation Initiatives**: Addressing resource-based conflicts (e.g., water, land) through mediation and trust-building efforts.
- **Political Support for Peacebuilding**: Linking development projects with reconciliation programs can strengthen peace efforts.
- **Empowering Youth & Women**: Engaging youth and women in resource management, leadership, and **peacebuilding** fosters stability.

### 5. The Urgent Need for Sustainable Development

- **Situation**: Ongoing crises in **Yemen** have heightened the demand for sustainable solutions addressing the root causes of issues.
- **Opportunity**: Implement integrated projects that link **humanitarian** response with long-term **development**. Improve infrastructure such as water, health, and education services to support triple **Nexus** initiatives.

### 6. Engaging Youth and Women

- **Situation**: Youth and women constitute a significant proportion of the population and can contribute to **development** and **peacebuilding**.
- **Opportunity**: Design training and empowerment programs targeting youth and women, integrating them into resource management and **peacebuilding** efforts.

### 7. Sustainable Use of Natural Resources

- **Situation**: **Yemen** has unexploited natural resources, including agricultural land and marine assets.
- **Opportunity**: Launch sustainable agricultural and marine fishing projects to create jobs and support food security.

### 8. Increased Donor Awareness

- **Situation**: Donors increasingly recognize the need for comprehensive programs that integrate relief, **development**, and peace.
- **Opportunity**: Capitalize on this trend to secure financial and technical support for integrated programs.

### 9. Climate Change as a Driver for Programming

- **Situation**: Yemen faces **climate change** impacts such as droughts and floods.
- **Opportunity**: Develop climate-responsive projects, such as modern irrigation and solar energy initiatives, to strengthen the **humanitarian-development Nexus**.

### 10. Engaging Local Communities

- **Situation**: Local communities possess extensive knowledge of their needs and challenges.
- **Opportunity**: Strengthen community participation in program design and implementation, ensuring sustainability through community-led initiatives.

### 11. Political Support for Peacebuilding

- **Situation**: International and local parties increasingly support peace efforts in Yemen.
- **Opportunity**: Implement reconciliation programs, such as tribal dialogues and conflict resolution projects, linking them with **development** efforts.

### 12. Global Attention on Yemen

- **Situation**: Yemen is a focal point of **international humanitarian** concern.
- **Opportunity**: Attract funding and advocacy for **Nexus** programming by leveraging global attention to support integrated approaches beyond short-term relief.

These outlines can be described as follows: triple **Nexus** programming is an essential strategy to solving Yemen's numerous issues. Organizations such as the **Correction Foundation** can contribute to long-term solutions that combine relief, **development**, and **peace** by capitalizing on existing opportunities, enhancing coordination, and overcoming obstacles. Strategic investments in partnerships, innovation, and community engagement will be required to achieve long-term impact and resilience in Yemen.

## 12. Funding Mechanisms for the Nexus Program in Yemen

In Yemen, effective funding mechanisms are crucial to advancing the **Nexus approach**, which integrates **humanitarian** aid, **development**, and **peacebuilding**. Given the country's prolonged crises, donor strategies must shift towards long-term, flexible, and results-driven financing to ensure sustainable impact. Strengthening partnerships, supporting local organizations, and promoting innovative funding models can enhance the efficiency and effectiveness of **Nexus** programming in Yemen.

### Key Opportunities

**1. Long-Term and Flexible Funding**

- **Challenge:** Short-term funding limits sustainability and strategic planning.
- **Solution:** Donors should provide multi-year funding to ensure long-term program impact and allow organizations to adjust to changing **humanitarian** and **development** needs.

**2. Strengthening Strategic Partnerships**

- **Challenge:** Limited coordination between donors, **humanitarian**, and **development** actors.
- **Solution:** Encourage joint funding mechanisms where multiple donors collaborate on integrated programs, avoiding duplication and fragmentation.

**3. Increased Support for Local Organizations**

- **Challenge:** Local organizations lack financial and technical resources to lead **Nexus** initiatives.
- **Solution:** Capacity-building investments for local organizations in financial management, project development, and governance, allowing them to take ownership of **Nexus** programs.

**4. Results-Based Financing and Monitoring**

- **Challenge:** Funding is often tied to activities rather than measurable outcomes.
- **Solution:** Shift towards results-based financing, where funding is linked to achieving **development**, **humanitarian**, and **peacebuilding** outcomes, using clear performance indicators.

**5. Supporting Innovation and Technology**

- **Challenge:** Limited use of digital tools for data-driven decision-making.
- **Solution:** Donors should invest in technology-driven solutions such as digital platforms for communication, data collection, and **early warning systems**.

**6. Research and Evaluation Investments**

- **Challenge:** Lack of context-specific data to inform **Nexus** programming.
- **Solution:** Provide funding for research, impact assessments, and evidence-based strategies to enhance program effectiveness.

**7. Simplified Funding and Administrative Procedures**

- **Challenge:** Complex funding requirements hinder local organizations from accessing funds.
- **Solution:** Reduce bureaucratic hurdles, introduce flexible reporting, and rely on self-evaluations with periodic donor audits.

**8. Integrating Gender and Community Engagement**

- **Challenge:** Women and marginalized groups are often excluded from decision-making in **Nexus** programs.
- **Solution:** Ensure gender mainstreaming in all program phases, empower women in leadership roles, and support community-driven initiatives.

To effectively support **Nexus** programming, donors must transition from short-term, activity-based funding to long-term, flexible financing that prioritizes local leadership, partnerships, results-based approaches, and innovation.

## 13. Monitoring the long-term impact of humanitarian and development efforts in Yemen.

Effective long-term monitoring of **humanitarian** and **development** programs is essential to ensuring their viability and impact. To review and improve the success of programs, some organizations, such as **Bard Al-Ataa Humanitarian Development Association**, employ a multifaceted approach that involves continual evaluation, data-

driven analysis, community participation, and strategic collaborations. The primary strategies for **HDP** impacts monitoring in Yemen are as follows:

### Key Strategies for Long-Term Impact Monitoring

1. **Integrated Monitoring and Evaluation System**

   Real-time data is captured utilizing quantitative (**KPIs**, statistics) and qualitative metrics (beneficiary experiences, behavior changes). Baseline studies and frequent follow-ups are used to track and analyze improvement.

2. **Post-Project Sustainability Assessments:**

   Independent evaluations are conducted six months to a year following project completion to assess long-term benefits in income production, food security, and healthcare access.

3. **Community-Led Evaluations**

   Local communities are engaged in monitoring procedures, improving ownership and providing a genuine assessment of needs and successes. Feedback sessions and participation workshops are used to improve project strategy.

4. **Advanced Data Analytics & GIS Technology**

   Big data and geospatial analysis (**GIS**) are used to track environmental and socio-economic changes over time. AI-powered data analytics are used to identify patterns and areas needing further intervention.

5. **Behavioral and Social Impact Tracking**

   Long-term transformation indicators include shifts in community attitudes, social cohesion, and gender equality. Longitudinal studies, focus group talks, and social perception surveys are used.

6. **Financial & Institutional Sustainability Analysis**

   Projects' potential to sustain itself post-funding is evaluated, including community-led maintenance, entrepreneurship models, and local policy support, while self-reliance mechanisms including cooperative business models and microfinance programs are supported.

7. **Technical Audits & Infrastructure Reviews**

   Infrastructure projects (water, sanitation, education, etc.) undergo periodic audits to maintain operational efficiency and longevity, while technical professionals

conduct frequent inspections to prevent system breakdowns and improve service delivery.

8. **Collaboration with Local & International Partners**

   Joint research is performed with universities and non-governmental organizations (**NGOs**) to improve data accuracy and best practices, while partnerships with **UN** agencies, donor organizations, and government authorities guarantee that impact tracking meets global standards.

9. **Adaptive Risk & Opportunity Analysis**

   Political, economic, and environmental risks are regularly reviewed in order to adjust resilience and crisis preparedness programs, which include early warning systems, flexible funding sources, and contingency planning.

10. **Transparent Reporting & Knowledge Sharing**

    Findings are documented, analyzed, and disseminated via public publications, conferences, and digital platforms, while lessons gained inform future program designs and impact policy-making at the local and international levels.

## 14. Enhancing the Design and Implementation of Nexus-Based Programs

The **Nexus approach** integrates **humanitarian** relief, **development**, and **peacebuilding** to create sustainable and impactful programs. To improve their design and implementation, organizations must adopt strategic measures that strengthen coordination, enhance community participation, and ensure long-term sustainability. The following important recommendations from participants highlight practical methods to improve **Nexus**-based programs' efficacy and resilience.

1. **Strengthening Coordination Between Sectors**

   Effective coordination between **humanitarian**, **development**, and **peace** actors ensures synergy and maximizes impact. Establishing coordination platforms, conducting regular joint meetings, and integrating sectoral strategies help align efforts and avoid duplication.

**2. Flexible and Sustainable Funding**

Programs require long-term and adaptable funding mechanisms to cover all **Nexus** aspects. Donors should support multi-year financing models, flexible funding pools, and community-led financial solutions to enhance sustainability beyond immediate relief efforts.

**3. Integrating Peacebuilding in All Stages**

**Peace** components must be embedded throughout the program lifecycle to promote stability and social cohesion. This includes conflict-sensitive programming, local mediation initiatives, and activities that address root causes of instability, ensuring long-term resilience.

**4. Strengthening Community Participation**

Local communities should be actively involved in program design, implementation, and evaluation. Conducting participatory assessments, organizing community-led decision-making forums, and building local capacity ensures interventions align with real needs and are culturally appropriate.

**5. Leveraging Technology and Innovation**

Utilizing digital tools enhances data collection, monitoring, and decision-making. Implementing AI-driven analytics, **GIS**-based assessments, open data platforms, and smart monitoring technologies improves efficiency, accountability, and responsiveness.

**6. Capacity Building for Local Actors**

Investing in the skills and leadership of local organizations, youth, and women strengthens their ability to manage programs independently. Providing technical training, leadership development, and institutional support ensures sustainable impact and resilience.

**7. Continuous Monitoring and Evaluation**

Establishing adaptive evaluation systems helps measure long-term impact and improve program effectiveness. Using integrated monitoring frameworks, real-time feedback mechanisms, and impact-driven assessments ensures evidence-based decision-making and strategic adjustments.

# II. Climate Change Impacts

## Part II: Climate Change Impacts and the Nexus Approach in Yemen

### Background

This section investigates how **climate change** affects **Nexus** programming in **Yemen** and how organizations incorporate climate resilience into **humanitarian**, **development**, and **peacebuilding** operations. The **Next** lines describe the participants' perspectives on the impact of **climate change** and **humanitarian** assistance in **Yemen**, as obtained from a questionnaire survey.

### 1. Key Observed Impacts of Climate Change in Yemen

Organizations operating in **Yemen** have identified several critical **climate change** impacts affecting the region. The most significant include:

- **Water Scarcity** – A persistent challenge, limiting access to clean water for communities and agriculture.
- **Flooding and Extreme Weather Events –** Repeatedly reported as a major concern, leading to displacement, infrastructure damage, and loss of livelihoods.
- **Desertification –** The expansion of arid land, reducing agricultural productivity and exacerbating food insecurity.
- **Increased Drought –** Prolonged dry periods affecting water availability, crop yields, and overall ecosystem stability.

These climate-related **challenges** highlight the urgent need for resilience-building strategies in **Yemen's** humanitarian, **development**, and **peacebuilding** efforts.

## 2. Addressing the Effects of Climate Change in Yemen.

Regarding **humanitarian** assistance initiatives in the context of the consequences of **climate change** on various **Yemeni** regions, the following question was posed to the survey participants: **Do your programs directly address the effects of climate change in Yemen? If the answer is yes, please provide examples.** The responses were as follows:

**Response Breakdown (Yes/No): Yes – 5 responses, No – 5 responses** (**Fig. 10**). This indicates that half of the surveyed organizations directly address **climate change** impacts in **Yemen**, while the other half do not have dedicated programs for this issue.

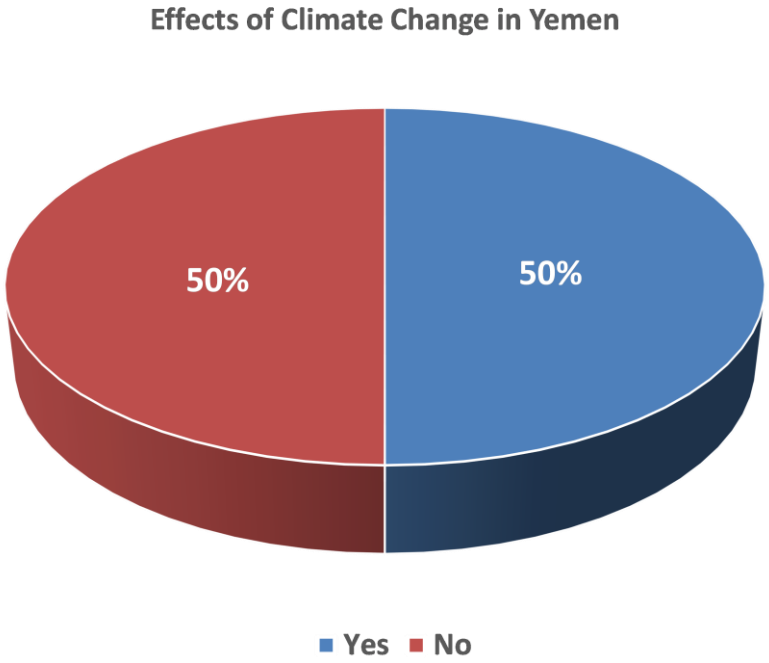


**Fig. 10**: The pie chart depicts the percentage of climate change's impact in Yemen (source: **the author**).

**Organizations that Address Climate Change**

The organizations that responded "**Yes**" implement a variety of strategies, including:

1. **Adaptation and Resilience Projects**
    - ❖ **Rehabilitation of Irrigation Systems:**

- Implementing modern irrigation techniques (e.g., drip irrigation).
- Training farmers in water conservation and sustainable agriculture.
- Constructing wells and rainwater harvesting systems to improve water access.

❖ **Climate-Smart Agriculture:**

- Promoting drought-resistant crops and soil conservation techniques.
- Using organic fertilizers to enhance sustainability.

2. **Water Management Initiatives**

❖ Building small dams, drilling wells, and implementing rainwater harvesting.

❖ Developing sustainable water storage and distribution systems.

3. **Community Awareness and Capacity Building**

❖ Conducting climate education campaigns.

❖ Training local communities on risk management and disaster preparedness.

4. **Environmental Protection and Disaster Mitigation**

❖ Reforestation programs to combat desertification and improve soil stability.

❖ Establishing early warning systems for extreme weather events.

❖ Constructing protective structures such as retaining walls and coastal barriers.

5. **Policy and Sustainable Development Support**

- ❖ Collaborating with **governments** to integrate climate adaptation into policies.
- ❖ Supporting **peacebuilding** efforts to create a stable environment for climate initiatives.

**Organizations That Do Not Directly Address Climate Change**

While these organizations do not have specific climate-focused programs, their broader **development** and **humanitarian** work may indirectly contribute to resilience by:

- Strengthening community infrastructure.
- Enhancing food security.
- Providing emergency response services during extreme weather events.

The responses highlight a growing awareness of climate change challenges in **Yemen**, with several organizations actively working on solutions. However, there is a gap in climate-specific programs among some organizations. Strengthening partnerships, integrating climate considerations into existing projects, and expanding funding for adaptation initiatives could enhance resilience efforts across the country.

## 3. Climate Change Impact on Displacement and Migration in Yemen

Migration and displacement in **Yemen** are significantly influenced by **climate change**, which exacerbates already-existing **humanitarian** issues. Many people have been compelled to relocate in quest of more secure living conditions due to factors like desertification, water scarcity, extreme weather occurrences, and diminishing agricultural production. In addition to highlighting the larger socioeconomic and conflict-related issues impacting displacement patterns, this analysis looks at survey responses to determine the amount of migration brought on by **climate change**.

## Response Breakdown and Statistical Analysis

1. **Significant Impact (Majority - 78%)**

   - **78% of respondents** believe that **climate change** has significantly influenced displacement and migration patterns in **Yemen**.
   - Extreme weather, desertification, water scarcity, and decreased agricultural output are the main causes of **Yemen's** displacement brought on by **climate change**. While the loss of arable land and water sources exacerbates economic instability and leads to increased migration, frequent flooding and droughts compel populations to shift in pursuit of more secure living conditions **(see Table 1, Fig. 10)**.

2. **Moderate Impact (11%)**

   - **11% reported a moderate impact**, indicating that while **climate change** contributes to migration, other factors may also play a role.
   - The **climate change** contributes to migration, socioeconomic and conflict-related factors may be equally or more significant drivers. However, some communities with adaptation strategies in place experience a reduced direct displacement effect (**Table 1, Fig. 10**).

3. **Minimal Impact (11%)**

   - **11% believe the impact is minimal**, suggesting that in some areas, **climate change** may not be the primary driver of migration.
   - In certain regions, conflict, economic conditions, and governance issues may have a greater influence on migration patterns than **climate change** alone. These areas may also exhibit greater resilience or face fewer direct climate-related pressures (**Table 1, Fig. 11**).

## Key Climate Change Impacts on Displacement and Migration

1. **Water Scarcity and Drought**

   - Reduced groundwater levels and severe droughts have caused agricultural decline, resulting in soil degradation and the forced displacement of numerous farmers. Competition for limited water resources has intensified,

causing community tensions and aggravating food shortages. As arable land becomes less productive, rural communities are compelled to migrate to cities in pursuit of alternate livelihoods, putting further strain on already overburdened infrastructure and public services. Without long-term water management and climate adaption policies, these issues will continue to jeopardize livelihoods, economic stability, and social cohesion.

2. **Floods and Extreme Weather Events**

   - Flooding and storms have rendered many homes unsuitable, forcing people to relocate owing to infrastructure damage such as destroyed roads, schools, and hospitals. The predicament for displaced people living in temporary shelters is exacerbated by their increased vulnerability to extreme weather.

3. **Desertification and Land Degradation**

   - Many farmers and pastoral communities have been forced to relocate into urban regions or neighboring nations as a result of the lack of arable land caused by expanding desert areas and soil erosion.

4. **Rising Temperatures and Food Insecurity**

   - Rising heat and droughts have led to food shortages and price inflation, causing many people to struggle to meet basic needs. Families are forced to relocate more frequently in search of better living conditions and food security.

5. **Sea Level Rise and Coastal Erosion**

   - Rising sea levels are forcing residents of coastal villages to relocate inland. Migration has been worsened by the loss of coastal livelihoods and fisheries, leaving many people without a source of income.

## Compounding Factors Worsening the Crisis

- **Armed Conflict: Climate change** worsens **humanitarian** conditions, while war destroys infrastructure, making adaptation more difficult.

- **Poverty:** High poverty rates make it harder for communities to cope with climate-related displacement.
- **Overstressed Resources:** Increased migration places pressure on host communities, worsening water and food shortages.
- **Loss of Livelihoods and Agricultural Lands:** Displaced individuals, particularly those from rural areas, have been forced to abandon their agricultural lands due to climate-induced challenges such as drought, desertification, and soil erosion. This has led to the loss of their primary sources of income, making them more vulnerable to poverty.

Table 1: Displays the proportion of questionnaire responses for **climate change** implications on displacement in Yemen.

| Impact Level | Responses | Percentage (%) |
|---|---|---|
| Significantly | 7 | 78% |
| Moderately | 1 | 11% |
| Minimally | 1 | 11% |

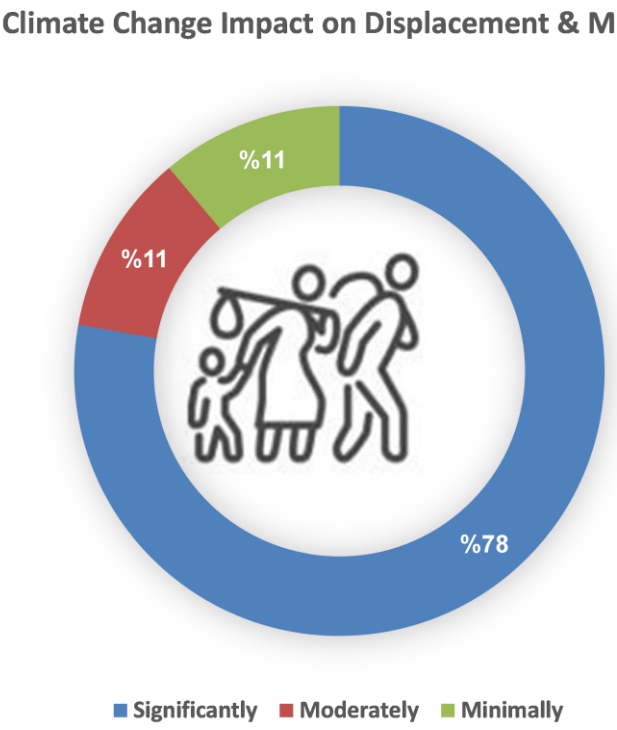


Fig. 11: The pie graphic shows the percentage of **climate change's** impact on **IDP** (source: **the author**).

- **Family Disintegration:** The displacement of families due to **climate change** has led to the fragmentation of households. As members search for work and safer living conditions in different regions, family unity is often disrupted, which further exacerbates their vulnerability and reduces support systems.
- **Increased Poverty Rates:** Many displaced people are now living in temporary shelters, facing extreme poverty due to limited access to basic services such as food, healthcare, and sanitation. The harsh conditions of these shelters, compounded by extreme temperatures (sun heat and winter cold), worsen their living standards, thereby increasing poverty.
- **Pressure on Resources in Receiving Areas:** The influx of displaced people into urban areas or safer regions puts immense pressure on local resources such as water, food, and shelter. As the demand for these resources increases, competition intensifies, potentially leading to further social conflicts and scarcity.

## Impact of Climate Change on Displacement and Migration Patterns:

1. **Drought:**

   Water scarcity, exacerbated by prolonged droughts, has severely affected agriculture and water availability, forcing rural populations to migrate in search of better living conditions and access to essential resources.

2. **Rising Temperatures:**

   Increasing temperatures have had a direct impact on agricultural productivity, leading to declining crop yields and increased food insecurity. This has forced many families to abandon their farms and migrate to urban areas or neighboring regions for better opportunities.

3. **Desertification:**

   The ongoing desertification process has led to the degradation of arable lands, pushing farmers and pastoral communities to seek more fertile land in urban centers or neighboring countries. This trend highlights the broader environmental threat of land degradation.

4. **Floods:**

   Increased flooding, driven by **climate change**, has resulted in the destruction of homes, infrastructure, and essential services. This has caused widespread displacement, particularly in coastal and low-lying areas that are more susceptible to flooding.

5. **Environmental Threats:**

   The cumulative effect of climate-induced environmental changes, including extreme weather events such as storms and floods, has driven internal migration as people flee to more stable regions in search of safety and a better quality of life.

## Types of Migration:

- **Rural to Urban Migration:** As rural areas become less habitable due to droughts and desertification, many displaced families are relocating to urban areas in search of water and economic opportunities.
- **Internal Displacement:** Families are moving within **Yemen** to areas less affected by climate change or to receive **humanitarian** assistance.
- **Cross-border Migration:** In some cases, displacement due to environmental threats has forced individuals to migrate to neighboring countries.

## Key Impacts on Communities:

- **Agricultural Decline:** Loss of livelihoods due to the destruction of farmland and reduced agricultural productivity.
- **Health and Shelter Issues:** Displaced people face inadequate shelter and are vulnerable to extreme weather conditions, which negatively impact their health.
- **Economic Pressures:** Increased poverty and reduced access to basic services are common among displaced populations, contributing to greater dependence on aid.

**Climate change** is a significant driver of displacement in **Yemen**, with droughts, floods, land degradation, and extreme weather events forcing people to leave their homes. Migration patterns are shifting towards urban areas and safer regions, increasing **humanitarian** pressures. Urgent climate adaptation strategies—such as improved water management, sustainable agriculture, and resilient infrastructure—are needed to mitigate future displacement and reduce vulnerabilities.

The statistics and grouping show that **climate change** is a significant driver of displacement in **Yemen**, contributing to the loss of livelihoods, family disintegration, and increased pressure on resources in receiving areas. As climate conditions worsen, the need for sustainable adaptation strategies and increased **humanitarian** support becomes more urgent to address the growing challenges faced by displaced populations.

## 4. Address Yemen's Climate Change Effects.

**Yemen's humanitarian** catastrophe is getting worse due to **climate change**, which is also causing migration and displacement. Many populations are compelled to relocate in quest of food, water, and safer living circumstances as a result of the growing frequency of droughts, floods, and desertification. Some organizations lack the resources to directly address these issues, while others actively pursue adaption measures like disaster mitigation, water management, and sustainable agriculture. This report looks at how well **Yemeni** organizations are addressing the effects of **climate change** and emphasizes the need for increased efforts to strengthen resilience in impacted communities. The following are the survey results for addressing **Yemen's climate change** effects (**Fig. 12**).

### Response Breakdown and Statistical Analysis

- **Yes: 50%** and **No: 50% responses**

This indicates that half of the surveyed organizations directly address **climate change** impacts in **Yemen**, while the other half do not have dedicated programs for this issue.

**1. Organizations Addressing Climate Change (Yes Responses – 50%)**

The organizations that actively tackle climate change impacts focus on:

- **Awareness & Education:** Conducting workshops, campaigns, and training programs to inform communities about **climate change**.
- **Water Resource Management:** Implementing projects to rehabilitate irrigation systems, drill wells, harvest rainwater, and introduce modern water-saving techniques.
- **Climate-Smart Agriculture:** Promoting drought-resistant crops, sustainable farming methods, and the use of organic fertilizers.
- **Disaster Mitigation:** Building retaining walls, stabilizing sand dunes, and setting up **early warning systems** to reduce climate-related disasters.
- **Afforestation & Land Protection:** Implementing reforestation projects to restore soil fertility and combat desertification.

**2. Organizations Not Addressing Climate Change (No Responses – 50%)**

Half of the respondents do not have programs directly targeting **climate change**. Possible reasons may include:

- Limited resources and funding constraints.
- Focus on other **humanitarian** or **development** priorities.
- Lack of technical expertise in climate adaptation strategies.

While **50%** of organizations are actively addressing **climate change**, the remaining half lack dedicated programs to mitigate its impacts. Expanding funding, technical support, and policy integration could help bridge this gap and enhance **Yemen's** resilience to **climate change** (**Fig. 12**).

## 5. Climate Adaptation, Resilience and Peacebuilding Efforts

### Statistical Analysis of Responses

**1. Integration of Climate Adaptation Strategies into Humanitarian Programming**

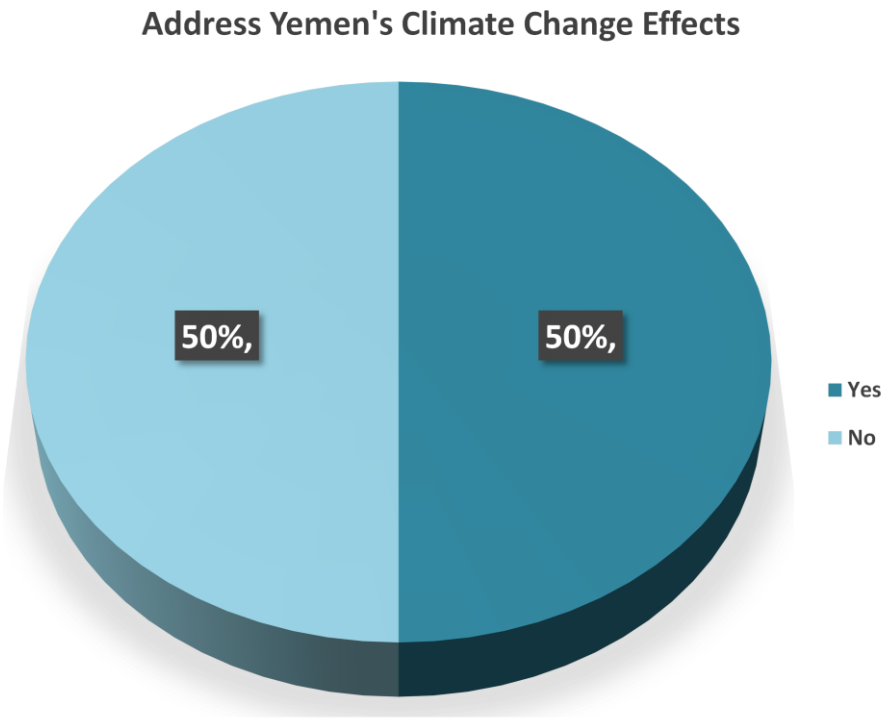


Fig. 12: The pie graph depicts the percentage of **climate change's** effects in Yemen (source: **author**).

**Yes:** 6 responses (**60%**) **No:** 4 responses (**40%**), (Table 2 and Fig. 13).

**Interpretation:** A majority (**60%**) of organizations incorporate climate adaptation strategies, but a significant portion (**40%**) still does not, indicating room for improvement in integrating climate resilience into humanitarian efforts.

**2. Peacebuilding Efforts to Mitigate Climate-Related Conflicts**

- **Yes:** 8 responses (**80%**), **No:** 2 responses (**20%**), (Table 2 and Fig. 13).

  **Interpretation:** Most organizations (**80%**) recognize the link between climate change and conflicts (e.g., over water and pasture) and actively incorporate peacebuilding efforts to mitigate these challenges.

**3. Community Engagement in Building Climate Resilience and Adaptability**

- **Yes:** 6 responses (**60%**), **No:** 4 responses (**40%**), (Table 2 and Fig. 13).

**Interpretation:** While **60%** of organizations engage with communities to enhance climate resilience, the remaining **40%** do not, highlighting the need for broader participation in resilience-building programs.

**Table 2:** The Responses **Climate** Adaptation, Resilience and **Peacebuilding** Efforts.

| Question | Yes (%) | No (%) |
|---|---|---|
| **Integration of climate adaptation strategies into humanitarian programming** | **60%** | **40%** |
| **Peacebuilding efforts to mitigate climate-related conflicts** | **80%** | **20%** |
| **Community engagement in climate resilience** | **60%** | **40%** |

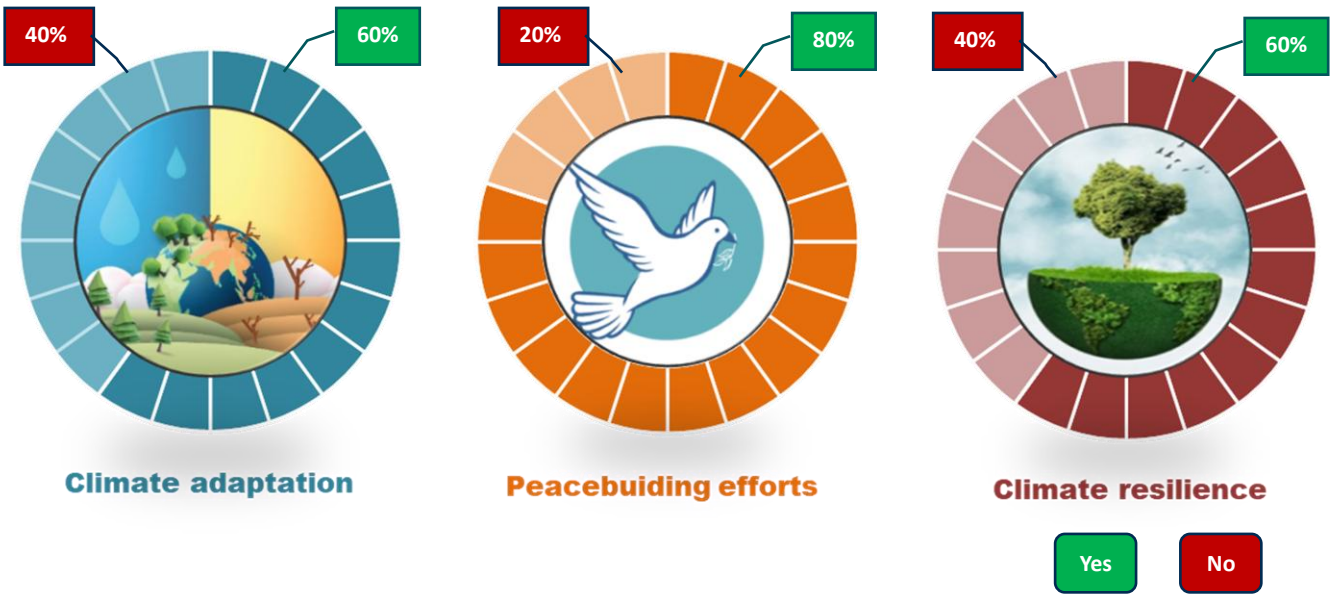


**Fig. 13**: The circle graphs depict the percentage of **climate** and **peace** effects in **Yemen** (source: **author**).

## 6. Collaborating with Local Communities to Increase Climate Adaptation and Resilience

Effectively tackling the issues brought on by **climate change** requires working with local people to improve resilience and climate adaptation. **Local** communities are frequently at the forefront of **climate changes** and have important knowledge about their surroundings. By collaborating with these communities, strategies for adaptation can be customized to meet local requirements, improving their capacity to foresee, address, and recover from disruptions brought on by **climate change**. This partnership ensures that climate adaption initiatives are both realistic and effective by empowering communities to create sustainable solutions and fostering long-term resilience.

### Engagement Strategies and Activities

- **Bureau sessions and meetings**: Facilitating discussions and knowledge exchange to develop localized climate adaptation strategies.
- **Local handicrafts and rooftop afforestation**: Supporting economic diversification and environmental sustainability by promoting sustainable livelihoods.

### Holistic Approach to Climate Adaptation

Some **local** organizations, like the **Bard Al-Ataa Humanitarian Development Association**, work closely with communities to improve resilience and increase their ability to adapt to **climate change**. The strategy is focused on empowering **local** communities through education, resource distribution, and sustainability-oriented actions because of their pivotal role in tackling climate concerns.

### Important Projects:

1. **Training on Climate Adaptation Techniques**

   Farmers and local people participate in workshops on drought-resistant farming and efficient water management, with an emphasis on methods like

drip irrigation systems that maximize crop yields in arid areas while consuming the least amount of water.

2. **Participatory Adaptation Strategies**

   In order to guarantee region-specific solutions, local adaptation strategies are created in partnership with communities. One such strategy is the creation of community committees to manage floods and droughts through local infrastructure projects like modest water reservoirs and rainwater harvesting.

3. **Sustainable Natural Resource Management**

   Long-term resource sustainability is ensured by improving land and water management practices, such as planting trees on degraded areas and conserving soil.

4. **Infrastructure Strengthening**

   Communities are supported in rebuilding and enhancing climate-resilient infrastructure, including deploying solar energy systems in remote areas to provide sustainable electricity and mitigate power outages.

5. **Empowering Youth and Women in Climate Resilience**

   Youth and women are given access to education and training programs on environmental governance, water conservation, and sustainable agriculture. These programs include resource management workshops and campaigns to promote women's involvement in climate adaptation decision-making.

6. **Innovative Climate Solutions**

   Building flood-resistant housing and installing renewable energy sources in disaster-prone locations are two examples of technology-driven strategies being used to lessen climate issues.

7. **Monitoring and Assessment of Climate Change Impacts**

Data-driven methods, such as the use of **Geographic Information Systems (GIS)** to track environmental changes and their effects on nearby communities, are used to evaluate climate risks and develop focused adaption strategies.

## Fundamental Ideas of the Approach

- **Needs Assessment**: Engaging with local leaders to understand specific climate vulnerabilities.
- **Capacity Building**: Providing training in drought-resistant agriculture, efficient water use, and disaster preparedness.
- **Community-Led Decision Making**: Ensuring active participation in project planning and implementation.
- **Institutional Strengthening**: Empowering local organizations and councils to drive sustainable change.
- **Partnership Development**: Collaborating with **local** and **international** stakeholders to maximize impact.
- **Sustainable Financing**: Providing funding opportunities for community-driven projects.

## Project Highlights

- **Small-Scale Irrigation Projects**: Establishing irrigation systems utilizing rainwater or groundwater sources.
- **Early Warning Systems**: Developing mechanisms to anticipate and mitigate natural disasters.
- **Training of Trainers (ToT)**: Equipping local trainers to disseminate knowledge and expand impact.

## Long-Term Goals

1. Strengthen climate resilience at the community level.

2. Enhance food and water security.
3. Promote environmental conservation.
4. Support sustainable development initiatives.

## Impact and Future Outlook

By enabling local communities to take the initiative to address **climate change** issues, these programs guarantee sustainability and long-term resilience. Because these activities align with broader **development** and **humanitarian** aims, they support the need for integrated climate adaptation approaches in **humanitarian** projects. By linking climate adaptation to disaster risk reduction and sustainable development, both organizations make a substantial contribution to enhancing community resilience to **climate change**. Although **peacebuilding** initiatives targeting climate-related conflicts are well-integrated (**80%**), there is a moderate gap between community resilience efforts (**40%**) and climate adaptation methods (**40%**). This implies that long-term climate adaption and sustainability projects need to receive increased focus.

# 7. Challenges Facing Organizations in Addressing Climate Change in Yemen

## Key Observations and Comments

1. **Funding Constraints Dominate**

   A substantial majority (**82%**) of respondents said the biggest difficulty is a lack of financing for climate-specific activities, indicating financial restrictions as a major impediment to successful climate action in **Yemen**. To secure long-term solutions, this issue must be addressed through increasing donor engagement, creative finance mechanisms, and the integration of climate measures into larger **development** programs (**Table 3**).

Table 3: Frequency Distribution of Identified Challenges.

| Challenge | Frequency | Percentage (%) |
|---|---|---|
| Lack of funding for climate-specific initiatives | 9 | 82% |
| Limited technical expertise | 1 | 9% |
| Other | 1 | 9% |

2. **Need for Technical Expertise**

   **9%** of respondents identified limited technical skills as a difficulty, highlighting the importance of capacity-building and specialized knowledge in effective climate adaption initiatives, in addition to finance concerns.

3. **Other Challenges Exist but Are Less Reported**

   The presence of an "**Other**" category (**9%**) indicates that there may be less often cited difficulties that need more examination.

### Recommendations

- **Increase Climate-Specific Funding:** Advocate for **international** climate funds and partnerships to support adaptation efforts.
- **Capacity Building:** Invest in training programs to enhance technical expertise in climate resilience and adaptation strategies.
- **Further Research:** Conduct in-depth assessments to explore additional barriers not captured in this survey.

## Comprehensive Analysis of Challenges Facing Climate Change Efforts in Yemen

### Statistical Analysis of Immediate Challenges

The survey responses indicate that **82% of organizations cite lack of funding** as the primary obstacle, followed by **limited technical expertise (9%)**, and **other challenges**

**(9%)**. This overwhelming emphasis on financial constraints aligns with broader structural issues affecting **Yemen's** climate adaptation efforts.

## Broader Contextual Challenges in Addressing Climate Change in Yemen

Aside from financial and technical obstacles, **climate change** activities in **Yemen** are hampered by interconnected problems such as conflict, **humanitarian** crisis, poor governance, and climate unpredictability. Ongoing violence has damaged institutions, restricting the **government's** capacity to carry out climate policies and disaster response plans. **Humanitarian** crises, like as food insecurity and **displacement**, take resources away from long-term adaptation strategies. Additionally, weak governance and fragmented institutions impede environmental regulation and resilience building. Unpredictable climate trends, such as unpredictable rainfall, lengthy droughts, and severe weather events, exacerbate vulnerability, particularly in rural and coastal areas. Addressing **climate change** without a strong political and economic base necessitates integrated measures that strike a balance between **humanitarian** help, **development**, and sustainability (**Table 4**).

**Table 4**: Shows the impact of **climate change** efforts in **Yemen**.

| Key Challenge | Impact on Climate Change Efforts |
|---|---|
| **Ongoing Conflict** | Infrastructure destruction, displacement, limited access to project sites |
| **Humanitarian Crisis** | Competition for resources, focus on basic survival rather than long-term climate solutions |
| **Lack of Data & Information** | Inability to assess climate risks, difficulty in planning adaptation strategies |
| **Limited Funding** | Insufficient resources for large-scale climate initiatives, donor prioritization of short-term humanitarian relief |
| **Institutional Weakness** | Lack of governance capacity, corruption, weak policy implementation |
| **Rapid Climate Change** | Unpredictable weather patterns, making long-term adaptation difficult |

## Key Insights & Link to Statistical Findings

1. **Funding is the Most Pressing Challenge**

   The statistics (**82% citing a lack of funds**) suggest that financial restrictions are the most pressing concern. This is supported by a broader analysis, which shows that rivalry with **humanitarian** needs and misaligned donor objectives hinder climate-specific funding. The scarcity of resources prohibits groups from executing large-scale climate projects, as most financing is allocated toward immediate **humanitarian** disasters rather than long-term climate adaptation activities.

2. **Technical Expertise & Institutional Weakness Are Secondary but Critical Barriers**

   The **9%** citing limited technical expertise highlights the need for capacity building. Weak institutional frameworks, governance issues, and corruption further exacerbate this challenge, making it difficult to formulate and implement effective climate policies. The lack of trained personnel and institutional capacity limits the ability of organizations to develop and execute adaptation strategies, resulting in inefficient resource management and reduced impact.

3. **Conflict and Humanitarian Crisis Amplify Funding and Implementation Challenges**

   The increased fighting causes infrastructure damage and restricts access, making even well-funded initiatives difficult to implement. Instability and security concerns impede project implementation, slowing climate adaption efforts. Furthermore, the **humanitarian** crisis drives organizations to prioritize immediate survival over long-term climate resilience, devoting attention and resources away from climate-focused activities and toward emergency relief efforts.

4. **Lack of Data Undermines Strategic Planning**

   Without reliable climate data, it is difficult to assess risks and design effective adaptation strategies. The absence of comprehensive studies and accurate field data makes it challenging to prioritize interventions and allocate resources effectively. Conflict and instability further limit data collection efforts, leaving

organizations without the necessary information to develop evidence-based climate policies and adaptation measures.

## Strategic Recommendations to Overcome These Challenges

Despite these barriers, organizations can enhance their impact through **strategic interventions**:

1. **Innovative Funding Mechanisms**

   To reduce reliance on **humanitarian** aid, organizations should advocate for climate-focused **international** funding and seek alternative financing sources. Exploring public-private partnerships can also provide sustainable financial support for climate adaptation initiatives. Diversifying funding streams will help ensure long-term project viability and reduce dependency on short-term relief funds.

2. **Capacity Building & Knowledge Sharing**

   Investing in technical training for local experts and institutions is crucial for strengthening climate adaptation efforts. Enhancing climate data collection through partnerships with universities and global monitoring agencies will provide accurate information for decision-making. Building local capacity ensures that communities and organizations can implement effective, evidence-based strategies to address **climate change**.

3. **Policy & Governance Strengthening**

   Collaborating with international agencies can improve institutional frameworks for climate governance, ensuring more effective policy implementation. Addressing corruption through transparency measures will enhance trust and ensure better resource allocation. Strengthening governance structures will create a more supportive environment for long-term climate resilience initiatives.

4. **Integrated Humanitarian & Climate Strategies**

   Embedding climate adaptation into **humanitarian** aid programs will help bridge the gap between emergency response and long-term sustainability. Promoting community-based adaptation by empowering local populations with knowledge

and resources ensures that climate strategies are locally driven and sustainable. Integrating these efforts will enhance resilience while addressing immediate **humanitarian** needs.

## 8. Resources and Collaborations to Strengthen Yemeni Local Organizations' Ability to Combat Climate Change

### Enhancing Climate Change Response in Yemen Through Tools and Partnerships

Yemeni groups working on **climate change** adaptation can gain more clout by combining technical tools, strategic partnerships, and financial innovations. A diversified strategy is necessary to increase resilience because of the nation's high susceptibility to climate-related calamities. Decision-making and adaptation efforts can be strengthened by having access to geospatial data, climate prediction models, and renewable energy technology. Collaborations with global organizations, academic institutions, and regional stakeholders offer vital knowledge, resources, and information to improve climate resilience. Long-term environmental solutions can also be supported by financial innovations like **public-private partnerships** (**PPPs**) and the **Green Climate Fund** (**GCF**). Organizations in Yemen can overcome current obstacles and create long-term climate adaption plans by utilizing these resources and encouraging cooperation among many sectors.

### Statistical Analysis of Tools and Partnerships for Addressing Climate Change in Yemen

The answers to the questionnaire emphasize how important partnerships and tools are to strengthening Yemen's efforts at climate adaption. The majority of participants (**60%**) agreed that their organization needed certain relationships and tools to increase its capability, however **40%** said that these resources were not available. This shows that in order to effectively address climate concerns, there is a high requirement for funding instruments, technical assistance, and strategic partnerships. The percentage of questionnaire replies is displayed in Table 5 and Fig. 14.

Table 5: The response on strengthening Yemen's climate adaptation efforts.

| Response | Frequency | Percentage (%) |
|---|---|---|
| Yes | 6 | 60% |
| No | 4 | 40% |

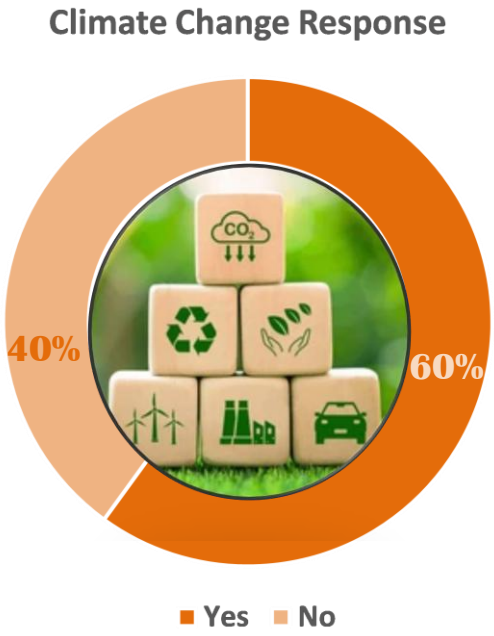


Fig. 14: The proportion of responses on Yemen's climate adaptation efforts. (Source: **the author**).

## Critical Reflections and Observations

1. **Majority Support for Tools & Partnerships**

**60%** of respondents believe that specific tools or partnerships would enhance their organization's capacity to address **climate change** in Yemen, highlighting the recognized need for external support, collaboration, and technical resources to improve climate adaptation efforts.

2. **Significant Minority Expresses No Need**

   **40%** of respondents do not believe tools or partnerships are necessary, which could indicate satisfaction with existing resources or a lack of awareness about potential external support mechanisms.

3. **Potential Reasons for Seeking Partnerships**

   Given the aforementioned challenges—insufficient funding, a lack of technical expertise, and ineffective governance—partnerships may provide opportunities for capacity building, information sharing, and financial support. Climate modeling technologies, **geospatial analysis software** (such as **ArcGIS**), and international alliances could all help with climate resilience planning significantly.

4. **Need for Further Assessment**

   It is critical to determine whether technology tools, financial partnerships, or policy collaborations are the most desirable types of partnerships and tools for organizations seeking to personalize solutions.

# Proposed Solutions

## Important Resources and Technologies for Adapting to Climate Change

While **satellite imagery** and **remote sensing** aid in tracking changes in vegetation, water levels, and disaster impact assessments, geospatial and climate monitoring tools like **Geographic Information Systems (GIS)** allow for the precise identification of climate-affected areas, facilitating better planning and intervention. Climate prediction models also aid in the development of **early warning systems** and the forecasting of extreme weather events. Regarding renewable energy and sustainable technology, smart agriculture technologies like precision irrigation and climate-resilient crop practices increase food security, while solar and wind energy solutions alleviate power outages and lessen reliance on fossil fuels. Water scarcity is also mitigated by **water management systems**, which include innovations like desalination and rainwater collecting. Additionally, digital and community engagement tools are essential.

Community-based monitoring encourages local populations to report environmental risks and changes, while mobile applications facilitate data collecting, climate awareness campaigns, and **early warning** notifications.

### Strategic Partnerships for Climate Resilience

Enhancing adaptive capability and sustainability requires strategic collaborations for climate resilience. While global environmental **NGOs** (**WWF**, **Red Cross**, **Oxfam**) provide assistance in conservation, disaster response, and community resilience-building, partnerships with international organizations, such as **United Nations agencies** (**UNDP**, **UNEP**, **FAO**, and **World Bank**), offer technical expertise, funding, and policy guidance. By collaborating with the ministries of agriculture, water, and environment to formulate policies and with **local government** agencies and environmental offices to carry out adaptation programs tailored to individual communities, **government** and institutional collaboration bolsters national efforts. Engaging the private sector speeds up climate action; agri-tech and water management companies provide sustainable solutions for food and water security, while renewable energy companies encourage the uptake of clean energy in rural areas. Through studies and innovation, **academic** and **research collaborations** with **universities** and **climate research institutes** improve data-driven planning for climate adaption. Additionally, **public-private partnerships (PPPs)** propel long-term investments in environmental sustainability, while financial innovations and climate funds, including the **Green Climate Fund (GCF)** and carbon credits, aid in securing funding for resilience initiatives.

## 9. Institutional collaboration with Yemeni climate experts and agencies

Addressing **Yemen's** environmental issues requires climate partnership, especially when it comes to adaptation and resilience-building initiatives. Gaining knowledge on the scope of collaborations between organizations and climate specialists can help identify **Yemen's** climate response's advantages and disadvantages. The degree of cooperation between groups, the success of current alliances, and the possibility of

increased cooperation are all examined in this analysis. For a more successful climate policy in **Yemen**, this report identifies possibilities to enhance technical ability, boost resource mobilization, and promote multi-sectoral engagement by analyzing data patterns and reactions.

## Analysis & Interpretation

**Questionnaire response: Yes:** 6 responses (**54.5%**) **No:** 5 responses (**45.5%**).

There is a considerable degree of cooperation in climate-related projects, as evidenced by the slim majority (**54.5%**) of organizations that work with climate agencies or specialists. Nonetheless, **45.5%** do not take part in these collaborations, suggesting possible deficiencies in technical know-how, networking, or resource awareness. Increasing cooperation with climate experts could improve access to climate adaption solutions, promote knowledge sharing, and increase project efficacy—all of which are critical for tackling **Yemen's** environmental issues.

The responses indicate that several organizations in **Yemen** actively collaborate with climate agencies, experts, and institutions at local, regional, and international levels. The partnerships highlighted include:

- **United Nations Agencies (UNDP, UNEP, WFP, FAO, World Bank):** These partnerships provide technical expertise, funding, and policy support for climate adaptation projects.
- **Government Institutions (Ministry of Agriculture, Water, Environment, and Health):** Collaboration with these ministries focuses on policy development, water resource management, and climate-smart agriculture.
- **Research Institutions & Universities:** Organizations benefit from data analysis, scientific research, and climate modeling to enhance adaptation strategies.
- **Private Sector & NGOs:** Partnerships with renewable energy companies and environmental **NGOs** enable the development of innovative climate solutions such as sustainable agriculture and **early warning systems**.

### Key Observations:

1. **Moderate Engagement in Climate Collaboration:** While some organizations demonstrate strong engagement, the extent of participation varies. Some organizations primarily rely on expert consultations and reports, while others have structured collaborations with **UN** agencies and international bodies.
2. **Diverse Approaches to Climate Adaptation:** Organizations employ a range of tools, from **GIS** mapping and **satellite monitoring** to green financing and private-sector engagement. However, the effectiveness of these tools and strategies depends on institutional capacity and funding availability.
3. **Gaps in Awareness and Technical Capacity:** While many organizations recognize the importance of partnerships, there is room for increased collaboration, particularly in integrating advanced climate technologies and securing sustainable funding.
4. **Potential for Strengthening Coordination:** Existing partnerships indicate significant efforts, but a more unified national climate adaptation framework could enhance impact and reduce duplication of efforts among various organizations.

The data suggests that while many organizations in **Yemen** recognize the value of partnerships and tools in addressing **climate change**, collaboration levels and implementation capacities vary. Expanding partnerships, increasing access to technical expertise, and leveraging financial innovations will be crucial in strengthening **Yemen's** climate resilience efforts.

## 10. To What Extent Does Nexus Effectively Tackle Climate-Related Issues in Yemen?

The **Nexus approach**, which combines **development**, **peacebuilding**, and **humanitarian** aid, is becoming more and more acknowledged as a strategy for dealing with **Yemen's** climate-related issues. Evaluating **Nexus's** performance in addressing the nation's resource constraint, environmental degradation, and susceptibility to

catastrophic weather events is crucial. In order to strengthen climate resilience and sustainable development initiatives, this section evaluates reactions regarding the approach's perceived performance, emphasizing important trends and opportunities for progress.

## Analysis & Interpretation

**Questionnaire response: Very well:** 3 responses (**30%**), **Moderate:** 4 responses (**40%**), **Poor:** 3 responses (**30%**) (**Table 6**).

**Table 6:** Statistical analysis of the **Nexus** approach in **Yemen.**

| Response Category | Number of Responses | Percentage (%) |
|---|---|---|
| Moderately well | 4 | 40% |
| Very well | 3 | 30% |
| Poorly | 3 | 30% |
| Total | 10 | 100% |

## Interpretation:

1. **Mixed Perceptions of Success:** While **70%** of respondents believe the **Nexus approach** is at least moderately successful in addressing climate-related challenges, only **30%** consider it very successful. This suggests a recognition of its effectiveness but also highlights room for improvement.
2. **Significant Concerns:** With **30%** of respondents rating the approach as "**poorly**" effective, there is a notable portion of stakeholders who believe the **Nexus approach** is falling short, possibly due to implementation gaps, coordination challenges, or resource limitations.
3. **Potential for Improvement:** The relatively low percentage of respondents rating the approach as "**very well**" (**30%**) indicates that while the **Nexus**

**approach** has promise, it may need refinement in execution, stronger partnerships, or increased funding to maximize impact (Fig. 15)

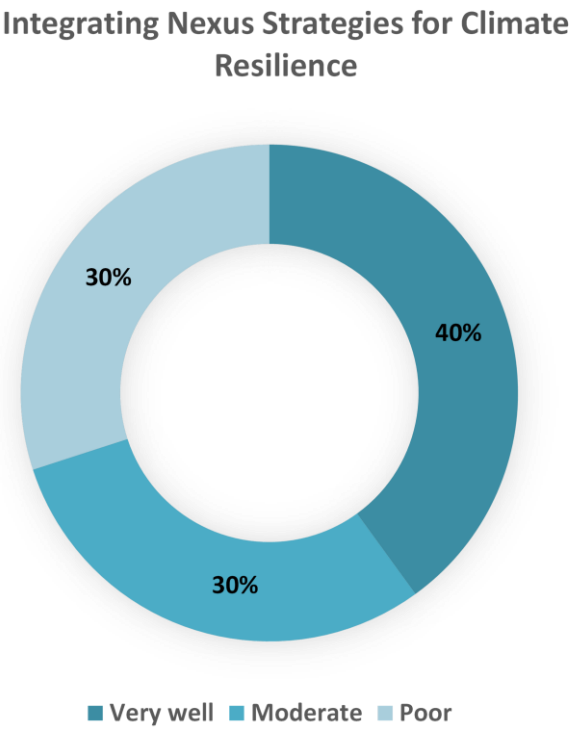


Fig. 15: A graph shows the percentage of **Nexus** strategies for climate resilience in Yemen. (Source: **the author**).

## Assessing the Nexus Approach's Performance in Resolving Yemen's Climate Issues

The **Nexus** strategy, which combines **development**, **peacebuilding**, and **humanitarian** help, may offer Yemen long-term answers to its climate-related problems. However, evaluating its effectiveness necessitates examining both the enablers and the barriers to its application.

### The Major Benefits of the Nexus Approach

1. International Recognition
2. Multilateral Partnerships

3. Sustainability Focus
4. Innovative Initiatives
5. Knowledge Sharing

The **Nexus** concept is gaining international recognition as a powerful paradigm for solving linked issues like violence, poverty, and **climate change**. Strong collaborations between global and local organizations facilitate its implementation and increase resource sharing. By incorporating climate adaptation into **humanitarian** and **development** initiatives, the strategy promotes long-term resilience. Several unique programs have effectively combined disaster response and sustainable **development**, assuring long-term impact. In addition, insights from previous experiences are constantly used to refine best practices and enhance execution.

## Challenges Limiting Success

1. Ongoing Conflict
2. Funding Shortfalls
3. Institutional Weaknesses.
4. Coordination Gaps
5. Data Limitations

Political instability and security concerns cause ongoing conflict, which hinders program implementation. Funding deficiencies make long-term planning and sustainability difficult since financial resources are limited and inconsistent. Institutional problems within **government** agencies impede the successful implementation of **Nexus**-based projects. Coordination gaps among stakeholders result in fragmented efforts, decreasing the effectiveness of climate actions. Furthermore, data restrictions make it impossible to adequately estimate **Nexus** projects' impact on climate resilience.

## Path Forward: Enhancing the Nexus Approach

To improve the effectiveness of **Nexus** in tackling climate-related issues, several strategic measures should be taken:

- **Develop Clear Performance Indicators** – Establish measurable benchmarks to track progress.
- **Enhance Data Collection & Monitoring** – Regular assessments should provide insights for adaptive planning.
- **Strengthen Multi-Sectoral Coordination** – Improved collaboration among **humanitarian**, **development**, and environmental stakeholders will enhance impact.
- **Increase Funding & Resource Allocation** – Securing sustainable financing is critical for long-term success.
- **Engage Local Communities** – Ensuring participation from affected populations can improve program relevance and effectiveness.

The **Nexus** strategy provides a viable framework for solving **Yemen's** climate concerns; but its influence is limited by financial and structural limitations. While it is regarded as modestly effective, more success will necessitate stronger collaboration, increased money, and enhanced coordination. Improving resource allocation and involving local stakeholders more effectively will be critical to optimizing the long-term effects on climate resilience.

## 11. Assess the Impact of Climate Change Adaptation Activities.

Measuring the effects of **climate change** adaptation operations is critical for determining efficacy, refining tactics, and obtaining funding for future projects. However, many **Yemeni** organizations struggle to create effective monitoring and evaluation processes. This report investigates how organizations quantify their adaptation efforts, highlighting existing gaps and the need for better assessment frameworks.

## Statistical Analysis of Climate Change Adaptation Impact Measurement

Out of the **10** respondents, only **2 (20%)** indicated that their organization measures the impact of **climate change** adaptation activities, while **8 (80%)** do not. This suggests a significant gap in monitoring and evaluation efforts, which may limit the ability to assess the effectiveness of climate adaptation strategies. Strengthening impact measurement could help organizations refine their approaches, secure funding, and enhance long-term resilience (**Table 7, Fig. 16**).

**Table 7:** Impact Measurement of Climate Adaptation Activities.

| Response | Number of Responses | Percentage (%) |
|---|---|---|
| Yes | 2 | 20% |
| No | 8 | 80% |
| Total | 10 | 100% |

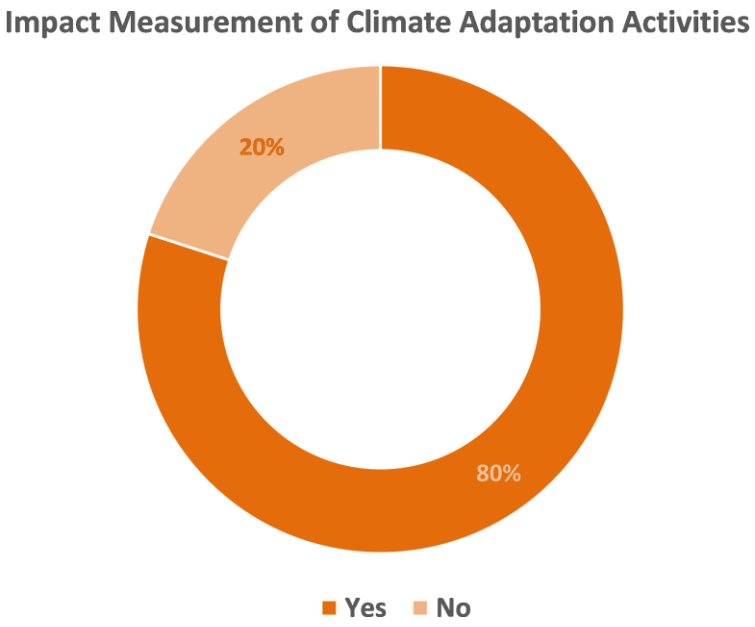


**Fig. 16**: Stakeholder Responses on **Climate** Adaptation Efforts in **Yemen.** (Source: **the author**).

## Evaluating Climate Change Adaptation: Insights from Local Organizations

Organizations that measure the impact of **climate change** adaptation activities use various indicators to assess effectiveness and sustainability. Common methods include reports, questionnaires, and meetings to track progress.

For example, some local organizations such as **Correction Foundation for Human Development** utilizes key performance indicators within the **Nexus approach**, focusing on:

1. **Food Security** – Evaluating improvements in food availability and sustainable income sources.
2. **Climate Adaptation** – Assessing the implementation of smart agriculture techniques and sustainable water management.
3. **Sustainability** – Measuring the long-term impact of renewable energy adoption and water conservation initiatives.
4. **Education and Training** – Tracking capacity-building efforts, particularly for youth and women.
5. **Peacebuilding** – Monitoring reductions in conflicts over natural resources due to improved management.
6. **Collaboration and Partnerships** – Analyzing the effectiveness of cooperation with local and international stakeholders.

In summary of the preceding session, the statistics show that, while some organizations actively measure the impact of their **climate** adaption efforts, the majority do not have organized monitoring frameworks. Those who do analyze impact prioritize food security, resource sustainability, and capacity development. Improving effect measurement through standardized frameworks and data gathering approaches could boost accountability and improve **climate** adaptation initiatives in **Yemen**.

## 12. Evaluating the Long-term Climate Resilience of Communities Assisted by Programs

**Community Needs Analysis**: Periodic field studies identify climate-related needs such as water management and agriculture, while questionnaires and interviews measure community awareness of climate challenges.

**Climate Adaptation Indicators**: Food security, agricultural diversification, smart irrigation systems, and environmental protection are assessed alongside the use of **geographic information systems (GIS)** and climate forecasting models to map risks and develop effective response strategies.

**Environmental and Social Impact Evaluations**: Periodic reviews determine the sustainability of climate adaptation strategies, while social and environmental studies ensure long-term benefits.

**Community Participation in Assessments**: Workshops and community meetings gather feedback on programs, while training initiatives equip communities to monitor environmental changes.

**Institutional Adaptation**: Evaluating the capacity of local institutions, including municipalities and local authorities, to support climate adaptation efforts.

**Financial Impact Analysis**: Assessing the financial viability and long-term sustainability of climate adaptation projects.

**2. Indicators Used for Long-Term Adaptation Capacity**

**Knowledge and Awareness**: Measuring community awareness of **climate change** impacts and their ability to relate these changes to daily life.

**Sustainable Practices**: Assessing the community's reliance on sustainable agricultural practices, water management, and livelihood diversification.

**Infrastructure and Resilience**: Evaluating infrastructure quality, including irrigation systems, sanitation, and flood protection.

**Community Organization and Innovation Capacity**: Assessing the strength of community organizations and their ability to make collective decisions, as well as measuring their capacity to develop innovative solutions to climate challenges.

**3. Evaluation Methods**

**Opinion Surveys**: Regular surveys to monitor shifts in community opinions and practices.

**Interviews and Group Discussions**: In-depth interviews with community leaders, farmers, women, and youth.

**Practice Monitoring**: Observing agricultural practices and natural resource management efforts.

**Secondary Data Analysis**: Analyzing climate and agricultural data to identify trends and changes.

**Impact Evaluation**: Conducting overall impact assessments to measure the effectiveness of programs in enhancing community resilience.

**4. Challenges in Assessing Adaptation Capacity**

**Limited Data**: The availability of data, especially in rural communities, is often scarce, making comprehensive evaluations challenging.

**Rapid Changes in Conditions**: Political instability and **climate change** effects cause rapid shifts in living conditions, necessitating continuous updates to assessment methods.

**Limited Capacity of Communities**: Some communities face challenges in participating in the assessment process due to illiteracy or resource constraints.

**5. The Importance of Community Participation**

**Design and Self-Assessment**: Communities participate in designing assessment tools and indicators, enabling them to self-assess their progress.

**Knowledge Exchange**: Workshops and training sessions facilitate the exchange of knowledge and experiences among community members.

**6. Practical Examples of Adaptation Projects**

**Water Management Projects**: Implementation of smart irrigation systems and drought-resistant farming techniques, along with assessing their impact on crop productivity and the economic capacity of farmers.

**Sustainable Agriculture**: The use of climate-resilient farming methods to improve food security and agricultural production.

**Disaster Preparedness**: Evaluating communities' readiness to cope with climate-related disasters.

Using a mix of these approaches and indicators, organizations can successfully assess and improve **Yemeni** communities' climate adaption capabilities. This strategy aids in identifying gaps, prioritizing actions, and developing long-term resilience to **climate change**. However, issues such as inadequate data and quick changes in community conditions must be addressed in order to increase the accuracy and comprehensiveness of assessments.

**Table 8:** Assessment methods and indicators.

| Assessment Area | Methods | Indicators |
|---|---|---|
| **Community Needs Analysis** | Field studies, questionnaires, and interviews | Community understanding of climate challenges and needs |
| **Climate Adaptation Indicators** | Use of GIS, climate models, smart irrigation | Improved food security, water management, biodiversity conservation |
| **Environmental & Social Impact** | Periodic reviews, social and environmental assessments | Long-term sustainability, social and environmental impact |
| **Community Participation** | Workshops, training, and community meetings | Feedback on program effectiveness and local decision-making |
| **Institutional Adaptation** | Evaluation of local authorities and institutions | Capacity of local institutions to support climate adaptation programs |
| **Financial Impact** | Financial feasibility studies | Long-term funding sustainability, operating costs |
| **Challenges in Assessment** | Limited data, rapid changes, limited community capacity | Accurate measurement of adaptation capacity in challenging environments |

## 13. The Procedures for Evaluating the Nexus of Climate Resilience, Development, and Peacebuilding

Assessing the **Nexus** of **climate** resilience, **development**, and **peacebuilding** is essential for guaranteeing long-term and conflict-sensitive adaptation solutions. While some organizations have built processes to assess these relationships, others face difficulties in incorporating comprehensive assessment systems. This review addresses how organizations quantify these interlinkages, identifies gaps, and makes recommendations for enhancing evaluation methods to improve long-term resilience and development results.

### Analysis of Climate Resilience, Development, and Peacebuilding Assessment Mechanisms

The responses indicate varying levels of integration of assessment mechanisms for **climate** resilience, **development**, and **peacebuilding** across different organizations. The data can be categorized into three groups: organizations that assess the intersection fully (**Yes**), those that do not assess it at all (**No**), and those that have partial mechanisms in place (**Partially**) (Table 9 & Fig. 17).

**Table 9:** Depicts the assessment mechanisms.

| Response Category | Count | Percentage |
|---|---|---|
| Yes (Assessment in place) | 5 | 50% |
| No (No assessment mechanisms) | 4 | 40% |
| Partially (Limited assessment mechanisms) | 1 | 10% |


Fig. 17: **climate** resilience, **development**, and **peacebuilding** assessment mechanisms in **Yemen.** (Source: **the author**).

## Major Findings

1. **Half of the respondents (50%) confirm that mechanisms exist** to assess the intersection of **climate** resilience, **development**, and **peacebuilding**. This indicates a growing recognition of the interconnections between these sectors.
2. **40% of organizations have no assessment mechanisms in place,** suggesting that many programs operate independently without structured evaluation of their combined impact.
3. **Only one organization (10%) reports a partial mechanism,** indicating an effort to integrate assessment but with gaps in implementation or methodology.

## Considerations and Future Directions

- **Strengthen Integration:** Organizations without assessment mechanisms should consider adopting structured frameworks to analyze how **climate** resilience, **development**, and **peacebuilding** interact.
- **Standardized Indicators:** Establishing common assessment indicators across organizations can improve comparability and enhance policy coordination.

- **Capacity Building:** Training and knowledge-sharing initiatives can help organizations develop effective mechanisms to measure the interconnected impact of their programs.
- **Funding and Support:** International donors and stakeholders should provide financial and technical support to organizations struggling to integrate assessment mechanisms.

**The next step**: Addressing these gaps allows organizations to take a more holistic approach to resilience building, resulting in more successful **climate** adaptation and conflict-sensitive **development** initiatives.

## 14. Intersection of Climate Change and Nexus HDP Challenges in Yemen

**Climate change** is reshaping the **humanitarian**, **development**, and **peacebuilding** environment in **Yemen**. Its impacts extend beyond environmental degradation to include resource availability, societal stability, and economic resilience. While some regard **climate change** as a chance for environmental cooperation and **peacebuilding**, others see it as a cause of resource-based conflicts and **humanitarian** catastrophes.

***By presenting the following question, participants' responses reflect diverse perspectives on the issue***: **In your opinion, how does climate change interact with humanitarian, development, and peacebuilding concerns in Yemen?**

### The responses were as follows:

1. **Enhances environmental cooperation**, which supports peacebuilding and development
2. **Has no direct impact**, as challenges depend on political and social factors
3. Ignites competition for resources such as water and land, which increases conflicts
4. **Increases natural disasters** such as droughts and floods, which exacerbates humanitarian crises.

## 15. Political and/or programmatic advice for climate change within the context of the triple nexus approach in Yemen

In response to the growing challenges posed by **climate change**, there is a need for comprehensive policy and programmatic solutions to enhance climate adaptation and resilience (**Table 10**). This is particularly true in **Yemen**, where **climate change** intersects with **humanitarian**, **development**, and **peacebuilding** concerns. Addressing these challenges requires a collaborative approach, and policy recommendations can help shape strategies for long-term sustainability. The following summarizes the key policy and programmatic recommendations offered by participants to better address **climate change** within the framework of the **Nexus approach** in **Yemen**.

Finally, **Yemen** can significantly increase its **climate** resilience by implementing these policy and programmatic recommendations under the **Nexus model**. These initiatives will not only address current **climate** concerns, but will also assure long-term sustainability by boosting local capacity building, inter-sectoral collaboration, and the use of both **local** and **international collaborations**. **Yemen** may better manage the complex intersection of **climate change**, **humanitarian** needs, and **development** goals by emphasizing community engagement, long-term finance, and incorporating climate adaptation into national **development** plans (**Table 10**).

**Table 10**: Policy and programmatic recommendations summary.

| Recommendation | Policy Recommendation | Programmatic Recommendation |
|---|---|---|
| Coordination Across Sectors | Strengthen coordination between relevant ministries (e.g., Water, Agriculture, Environment) | Implement integrated projects combining water management, agriculture, and environmental improvements in rural areas |
| Sustainable Financing for Climate Projects | Establish dedicated financing mechanisms to support climate adaptation | Target small and medium enterprises with soft loans for climate adaptation projects, like sustainable agriculture |
| Building Local Capacities | Support training and awareness initiatives at the community level | Offer training in drought-resistant agriculture methods and smart irrigation systems |
| Integration into National Development Plans | Incorporate climate adaptation into national development strategies | Develop adaptive agricultural and water management strategies based on future climate predictions |
| Strengthening International and Local Partnerships | Expand partnerships with international organizations to attract funding and technology | Collaborate with private sectors and NGOs for integrated solutions in water, renewable energy, and sustainable agriculture |
| Local Level Adaptation Strategies | Develop local strategies for climate adaptation and allocate resources | Prepare local action plans to improve infrastructure resilience and capacity to address climate challenges |
| Improved Climate Data and Monitoring | Enhance data collection and monitoring systems for climate change | Use GIS and remote sensing technologies for real-time monitoring of climate impacts |
| Strengthening Natural Resource Policies | Establish policies for sustainable management of natural resources like water and land | Implement projects for soil protection and sand stabilization in vulnerable areas |

## Trends in Climate Change and Its Intersection with Humanitarian, Development, and Peacebuilding Concerns in Yemen

Yemen is facing escalating climate-related issues, such as rising temperatures, extended droughts, and extreme weather events, which worsen current **humanitarian** disasters. **Climate** change's confluence with food insecurity, displacement, and resource constraint exacerbates vulnerabilities, hampering **development** and **peacebuilding** efforts. Weak governance and persistent violence impede the country's ability to adopt climate adaption methods, necessitating integrated efforts across **humanitarian** aid, sustainable **development**, and conflict resolution to ensure long-term stability and resilience. The following summarize the key trends and challenges at the intersection of **climate change**, **humanitarian** needs, **development** initiatives, and **peacebuilding** efforts in Yemen, highlighting the urgent need for coordinated and sustainable interventions (Table 11).

1. **Increasing Severity of Climate Events**: Yemen is experiencing more frequent and intense climate-related disasters, including droughts, floods, and extreme heat. These events exacerbate existing **humanitarian** crises, reduce agricultural productivity, and undermine the ability of communities to rebuild, making resilience efforts even more urgent.

2. **Water Scarcity**: Yemen's already limited water resources are further strained by **climate change**, with rising temperatures and reduced rainfall leading to a more significant water scarcity problem. The country's reliance on water-intensive agriculture exacerbates the strain, with groundwater resources depleting rapidly.

3. **Agricultural Vulnerability**: Agriculture, which is a key source of livelihood for the majority of Yemen's population, is increasingly vulnerable to changing climate conditions. Reduced rainfall and rising temperatures disrupt crop production, particularly in rural areas, and force farmers to adopt unsustainable coping strategies.

4. **Intersectoral Coordination Gaps**: Although the **Nexus approach** (**Humanitarian**, **Development**, and **Peacebuilding**) promotes integrated

interventions, Yemen lacks effective coordination across sectors. This results in fragmented approaches, especially regarding **climate change**, where **development**, **humanitarian**, and **peacebuilding** efforts often work in isolation rather than reinforcing one another.

5. **Migration and Displacement**: Climate-induced migration is becoming more common, with people forced to move due to both conflict and environmental degradation (e.g., droughts). These displaced populations are further burdened by **humanitarian** needs, complicating **peacebuilding** and **development** efforts.

6. **Increasing International Support**: **International** attention on Yemen's climate challenges is growing, with global and local organizations focusing more on climate adaptation and resilience-building programs. This includes financial and technical support for climate-smart agriculture, renewable energy solutions, and disaster risk reduction.

## Strengths of Addressing Climate Change within the Nexus Approach

1. **Integrated Solutions**: The **Nexus approach**, which integrates **humanitarian**, **development**, and **peacebuilding** efforts, enables holistic solutions. This integrated framework allows **climate** adaptation projects to address immediate needs while simultaneously fostering long-term resilience and peace.

2. **Community-Centered**: The emphasis on community participation and local capacity-building in addressing **climate change** ensures that solutions are relevant and sustainable. Local ownership helps ensure that the affected communities are empowered to adapt to the changing climate.

3. **Focus on Sustainable Practices**: The **Nexus approach** promotes sustainable practices such as climate-resilient agriculture, water conservation, and renewable energy. These initiatives help build resilience in vulnerable communities while addressing the immediate impacts of **climate change**.

4. **International and Local Collaboration**: The approach encourages collaboration among local institutions, international organizations, and the private sector, enabling the mobilization of resources and expertise to tackle complex **climate** and **development challenges**.

## Weaknesses in Addressing Climate Change within the Nexus Approach

1. **Lack of Effective Coordination**: While the **Nexus approach** calls for integration across sectors, in practice, there is often insufficient coordination between **humanitarian, development**, and **peacebuilding** sectors in **Yemen**. This leads to fragmented efforts, reducing the overall effectiveness of **climate change** adaptation.

2. **Limited Resources and Funding**: **Yemen** faces significant financial constraints, and while there is growing international support, the funding available for large-scale climate adaptation projects is still limited. This hampers the ability to implement widespread change, especially in rural or conflict-affected areas.

3. **Capacity Gaps at the Local Level**: Local institutions and communities often lack the technical expertise and resources to fully implement climate adaptation strategies. While the **Nexus approach** promotes capacity-building, the pace at which local skills are developed can be slow, especially in conflict zones.

4. **Political and Security Instability**: The ongoing conflict in **Yemen** limits the scope and effectiveness of climate adaptation efforts. Political instability undermines long-term planning and complicates the implementation of peacebuilding and development projects, making it harder to achieve climate resilience in the country.

5. **Data and Monitoring Challenges**: There is a lack of comprehensive data on **climate change** impacts and adaptation progress in **Yemen**. Without reliable monitoring systems, it becomes difficult to track progress, evaluate interventions, and adjust strategies effectively.

Table 11: Shows the trends, strengths, and weaknesses in addressing **climate change** within the **Nexus Approach**.

| Trends | Strengths | Weaknesses |
|---|---|---|
| Increasing severity of climate events (droughts, floods) | Integrated solutions addressing humanitarian, development, and peacebuilding needs | Lack of effective coordination between sectors |
| Water scarcity exacerbated by climate change | Focus on community-centered, sustainable practices | Limited resources and funding for large-scale projects |
| Vulnerability of agriculture to climate change | Local ownership and capacity-building | Capacity gaps at the local level |
| Intersectoral coordination gaps | Encourages international and local collaboration | Political and security instability complicates efforts |
| Migration and displacement due to climate stress | Supports long-term resilience-building | Lack of reliable data and monitoring systems |
| Growing international support for climate adaptation | Promotes renewable energy and climate-smart agriculture | Slow pace of local capacity development |

## Building a Resilient Future: Integrating Climate Adaptation into Yemen's Nexus Approach

Yemen faces a unique and complex intersection of **climate change**, **development**, and **peacebuilding** challenges. With increasing environmental threats such as droughts, water scarcity, and extreme weather events, the need for a **comprehensive and coordinated response** has never been greater. By integrating climate adaptation strategies into the **Nexus approach**, Yemen can develop more effective and sustainable solutions that address both immediate **humanitarian** needs and long-term resilience.

The interconnected nature of **climate change, conflict, and development** requires a shift towards holistic strategies that bring together local communities, policymakers, and international organizations. While there are promising efforts in place, challenges such as funding gaps, weak coordination, and limited data collection still hinder progress. Strengthening collaboration across sectors, investing in **climate-smart solutions**, and ensuring local participation are crucial steps toward building a future where Yemen's communities can adapt, thrive, and rebuild sustainably.

Addressing **climate change** within the **Nexus** framework is not just about **mitigating risks**—it's about empowering communities, fostering stability, and creating long-term **development** opportunities. The road ahead is challenging, but with strategic planning, strong partnerships, and innovative approaches, Yemen can turn these challenges into opportunities for a more resilient and sustainable future.

## Key Findings on the Nexus Approach in Yemen

1. **Sectoral Distribution in Yemen**

   Organizations prioritize **humanitarian** relief (**31%**), followed by **development** projects (**30%**). **Peacebuilding** initiatives account for **26%**, highlighting persisting issues in conflict resolution and governance. The remaining **13%** fall into the "**other**" category, which includes cross-sector projects that include numerous areas of engagement.

2. **Challenges Facing Humanitarian Organizations**

Financial constraints (**82%**) remain the fundamental obstacle, with funding shortfalls impeding long-term initiatives and project continuation. Administrative and structural constraints, such as bureaucratic hurdles, insufficient institutional capacity, and transparency difficulties, further reduce operational efficiency. Accessibility issues, such as security concerns, limited infrastructure, and competition from foreign groups, impede help delivery. Furthermore, conflict-related limitations, such as armed conflict and social disturbances, heighten **humanitarian** needs and impede program implementation.

3. **Coordination Among Nexus Sectors**

Coordination efforts show mixed results, with **30%** of participants rating them as strong while another **30%** perceive them as weak, highlighting inconsistencies in integration. Effective collaboration remains essential to aligning **humanitarian**, **development**, and **peacebuilding** initiatives for lasting impact.

4. **Climate Change Impact and Response**

Water scarcity, harsh weather, desertification, and droughts are all significant **climatic** impacts that promote food insecurity and relocation. In response, **50%** of firms are actively addressing **climate change** through climate-smart agriculture, water management, and disaster mitigation. Furthermore, **78%** of respondents see **climate change** as a major cause of displacement and migratory trends.

5. **Measuring Climate Adaptation Impact**

Only **20%** of organizations measure the impact of climate adaptation, while **80%** lack structured monitoring frameworks. Key indicators for assessing progress include food security, water conservation, sustainable energy use, and the effectiveness of **peacebuilding** efforts.

6. **Institutional Collaboration with Climate Agencies**

   While **54.5%** of organizations collaborate with climate agencies, **45.5%** lack such engagement, highlighting gaps in technical expertise and resource mobilization. Strengthening local, national, and international partnerships is essential for enhancing climate resilience initiatives.

## Conclusion

1. **Need for Stronger Integration of the Nexus Approach**

   Although organizations recognize the significance of integrating **humanitarian**, **development**, and **peacebuilding** initiatives, practical coordination is inconsistent. Building partnerships across these sectors is critical to achieving long-term resilience and stability.

2. **Climate Change as a Growing Threat**

   **Climate**-related disasters are becoming more frequent and severe, escalating **Yemen's** **humanitarian** crisis. Water scarcity, droughts, and displacement necessitate immediate adaptation methods to avoid further deterioration of conditions.

3. **Funding Gaps Hinder Long-Term Sustainability**

   Short-term funding cycles hinder the viability of **humanitarian** and **development** programs, necessitating results-based financing and novel funding structures, such as **climate** adaptation funds, to improve long-term resilience.

4. **Weak Monitoring and Evaluation Systems**

   The lack of established impact assessment frameworks hinders organizations' capacity to track progress and adapt initiatives, whereas improving data-driven decision-making increases accountability and program success.

5. **Community Engagement is Essential**

Local participation in program design and implementation promotes more sustainable and culturally relevant solutions, whilst training and capacity-building projects should aim to empower communities for long-term adaptation.

## Recommendations

**1. Strengthen Coordination Between Humanitarian, Development, and Peacebuilding Sectors**

Establishing joint coordination platforms to align interventions across the **Nexus approach** and enhancing data-sharing mechanisms are essential for improving efficiency and resource allocation.

**2. Expand Funding Mechanisms and Sustainable Financing**

Advocating for multi-year funding models that prioritize long-term **development** over short-term emergency relief, as well as encouraging **public-private partnerships (PPPs)** and **climate adaptation funds**, would help to attract investment in resilience projects.

**3. Improve Climate Change Adaptation Strategies**

Investing in climate-smart agriculture, water management, and disaster preparedness will assist to mitigate environmental hazards, while expanding **early warning systems** and **GIS-based monitoring** tools will improve climate vulnerability tracking.

**4. Enhance Monitoring, Evaluation, and Learning (MEL) Systems**

Creating standardized impact assessment frameworks to monitor climate adaption performance, as well as deploying real-time data collection tools like **GIS** and **AI analytics**, will enhance reporting and decision-making.

**5. Strengthen Institutional and Community Capacity**

Providing training and technical support to local groups for better governance and climate adaptation, as well as promoting women's and youth empowerment programs, will increase community-led resilience initiatives.

**6. Promote Policy and Legislative Support for Climate Resilience**

Advocating for climate adaptation policies and incorporating them into **national** development plans, as well as supporting environmental governance changes, will improve resource management and conflict resolution initiatives.

**7. Enhance Collaboration with International and Local Climate Agencies**

Expanding ties with **UNDP**, **UNEP**, **FAO**, and the **World Bank** to gain technical experience and finance, as well as improving academic and research connections, would help to enhance data-driven adaption plans.

## Final Thought

Addressing **Yemen's climate** challenges through the **Nexus approach** requires **stronger sectoral coordination, increased funding, community-driven adaptation efforts, and improved monitoring systems**. By leveraging local and international partnerships and integrating climate resilience into **humanitarian** and **development** planning, **Yemen** can build **a more sustainable and adaptive future**.

# PART V

# Recommendations

# Recommendations for Climate Change and Nexus Initiatives

## I. Recommendations for Integrating Climate Change into Future Nexus Initiatives

### Background

Climate change poses significant challenges to the interdependent systems of **water, energy, and food (WEF)**, necessitating an integrated approach to ensure sustainability and resilience. These recommendations aim to guide the incorporation of climate considerations into **Nexus** initiatives, ensuring they address both immediate and long-term challenges posed by climate variability and extreme events.

1. **Adopt a Climate-Informed Nexus Approach:**

   Incorporate climate change projections, risks, and adaptation strategies into the **WEF Nexus** framework to address interdependencies. Ensure climate-resilient planning across sectors, with a focus on vulnerable systems.

2. **Enhance Data-Driven Decision-Making:**

   Integrate climate models, remote sensing data, and geospatial tools into **Nexus** initiatives to improve forecasting and resource management. Utilize scenario-based analysis for long-term climate resilience.

3. **Strengthen Governance and Collaboration:**

   Promote cross-sectoral coordination between stakeholders, including governments, private sectors, and local communities, to align climate

objectives with **Nexus** priorities. Develop regulatory frameworks that support integration.

4. **Incorporate Ecosystem-Based Solutions:**

   Implement nature-based solutions like drought-resistant vegetation restoration and soil conservation to address water, energy, and food security challenges in arid regions.

5. **Mainstream Climate Finance:**

   Access climate funds to finance **Nexus** projects, ensuring the alignment of investments with both development and climate adaptation goals. Encourage private sector participation through incentives for green infrastructure and technologies.

6. **Capacity Building and Awareness:**

   Train stakeholders in climate-resilient **Nexus** practices and build awareness of **climate change** impacts at the community level to foster local engagement.

## Way Forward

To effectively integrate **climate change** considerations into future **Nexus** initiatives, it is essential to prioritize a holistic, collaborative, and adaptive approach. By embedding climate resilience into water, energy, and food systems, **Yemen** can address immediate vulnerabilities while laying the groundwork for sustainable development. Key steps include fostering multi-sectoral partnerships to align priorities, leveraging innovative technologies and data systems for informed decision-making, and securing long-term investments through climate finance mechanisms. Building capacity at all levels and incorporating ecosystem-based solutions will ensure that **Nexus** initiatives are not only climate-resilient but also equitable and inclusive, empowering local communities to actively participate in addressing shared climate challenges.

# II. Proposed Strategies and Action Plans to Strengthen Community Resilience

## Background

Building community resilience to climate change is critical for reducing vulnerabilities, enhancing adaptive capacities, and ensuring sustainable development. The following strategies and action plans focus on empowering communities, improving infrastructure, and fostering innovative solutions to help communities better cope with climate-related challenges.

### 7. Enhance Early Warning Systems:

- Develop community-based **early warning systems** for extreme weather events, integrating advanced technologies and local knowledge.
- Provide training to communities on interpreting alerts and implementing preparedness measures.

### 8. Promote Climate-Resilient Livelihoods:

- Support diversification of income sources (e.g., agroforestry, aquaculture) to reduce reliance on climate-sensitive sectors.
- Provide access to microfinance and climate insurance for smallholder farmers and vulnerable groups.

### 9. Improve Water Resource Management:

- Implement rainwater harvesting systems and promote efficient irrigation technologies.
- Restore and protect watersheds to ensure sustainable water supply during droughts.

### 10. Strengthen Infrastructure:

- Invest in climate-resilient infrastructure such as flood defenses, energy-efficient buildings, and decentralized renewable energy systems.
- Prioritize infrastructure projects in high-risk areas identified through **climate risk assessments**.

### 11. Foster Community Engagement and Leadership:

- Empower local communities through participatory planning and decision-making processes.
- Establish local committees to oversee climate resilience projects and maintain accountability.

### 12. Support Education and Knowledge Sharing:

- Integrate **climate change** education into school curriculums and community training programs.
- Create knowledge hubs to share best practices, innovations, and research on resilience-building strategies.

### 13. Leverage Digital and Technological Tools:

- Utilize **IoT**, **GIS**, and mobile applications to monitor climate impacts and disseminate critical information to communities in real time.
- Promote the use of smart agriculture tools for better resource optimization.

## Way Forward

Integrating **climate change** into **Nexus** initiatives and strengthening community resilience requires a coordinated, multi-sectoral approach that prioritizes governance, technology, and community participation. These strategies provide a robust

framework for addressing vulnerabilities, enhancing adaptive capacities, and achieving sustainable development in the face of climate challenges.

# III. Recommendations for Humanitarian, Development, and Peacebuilding Actors in Yemen

## Introduction

Yemen faces compounding challenges from protracted conflict, economic instability, and climate change, which exacerbates vulnerabilities in food security, water access, and livelihoods. **Humanitarian**, **development**, and **peacebuilding** actors must integrate **climate change** considerations into their work to address these interconnected issues and foster long-term resilience. The following are specific and actionable recommendations tailored to Yemen's context.

### 1. Humanitarian Actors: Building Climate-Smart Emergency Responses

- **Integrate Climate Risks in Needs Assessments:** Include climate vulnerability mapping in humanitarian assessments to identify high-risk regions and prioritize assistance accordingly.
- **Promote Climate-Resilient Shelter Solutions:** Design shelters and camps to withstand extreme weather events such as floods and heatwaves, incorporating energy-efficient and sustainable materials.
- **Enhance Water Access:** Invest in solar-powered water systems, rainwater harvesting, and rehabilitation of damaged wells to address water scarcity and reduce reliance on fuel-dependent systems.
- **Strengthen Food Security Responses:** Distribute drought-resistant seeds and climate-adaptive agricultural inputs to displaced and vulnerable farmers, ensuring emergency food aid is complemented by long-term solutions.

- **Early Warning Systems:** Develop community-based early warning systems for climate-induced disasters, integrating local knowledge with advanced forecasting tools.

### 2. Development Actors: Fostering Climate-Resilient Growth

- **Invest in Green Infrastructure:** Rebuild roads, water networks, and energy systems with climate-resilient designs to mitigate damage from floods, droughts, and other extreme events.
- **Support Sustainable Livelihoods:** Promote income-generating activities that are climate-resilient, such as agroforestry, aquaculture, and renewable energy-based enterprises.
- **Rehabilitate Ecosystems:** Implement large-scale reforestation and mangrove restoration projects to combat desertification, protect water resources, and reduce the impact of climate hazards.
- **Capacity Building and Education:** Train local communities and **government** officials in climate change adaptation and mitigation strategies, ensuring knowledge transfer and local ownership.
- **Integrate Climate Considerations into Policy:** Support the **Yemeni government** in developing climate-informed national and local development plans that address **climate change** and conflict dynamics.

### 3. Peacebuilding Actors: Aligning Climate and Peace Objectives

- **Address Climate-Conflict Linkages:** Incorporate **climate change** as a critical factor in conflict analyses and peacebuilding strategies to reduce competition over scarce resources like water and arable land.
- **Promote Collaborative Resource Management:** Facilitate community dialogues to address disputes over shared resources, ensuring equitable access and reducing tensions.

- **Ensure Climate-Sensitive Reconstruction:** Incorporate climate adaptation measures in reconstruction efforts, especially in rural areas, to foster stability and trust.
- **Strengthen Social Cohesion via Climate Action:** Engage communities in joint climate projects like reforestation and flood defense to build social bonds and alleviate grievances.
- **Mobilize International Climate Support:** Leverage global climate financing to fund peacebuilding initiatives that address the link between **climate change** and conflict.

## Way Forward

Integrating **climate change** considerations into humanitarian, development, and peacebuilding efforts in **Yemen** is essential to breaking the cycle of vulnerability and fostering long-term stability. By adopting these targeted actions, actors can address immediate needs while building a foundation for sustainable and climate-resilient recovery. Collaborative approaches that align climate, development, and peace objectives will ensure that **Yemen's** most vulnerable populations are equipped to face the dual challenges of conflict and **climate change**.

# IV. Recommendation for Developing an Effective Monitoring and Evaluation Framework for Climate Change Adaptation and Mitigation in Yemen

## Introduction:

To address **Yemen's** vulnerability to climate change, it is crucial to develop a robust, data-driven, and inclusive **Monitoring and Evaluation (M&E)** framework that ensures

the efficient tracking of adaptation and mitigation efforts. This framework should integrate key elements such as the use of technology, community engagement, and alignment with global best practices, while being context-specific to **Yemen's** socio-political and environmental challenges.

## Key components of the framework include

1. **Establish Multi-Tiered Context-Specific Indicators:**
   - ❖ Design national, regional, and sector-specific **KPIs** that reflect **Yemen's** climate vulnerabilities, such as water scarcity, agriculture, and coastal zone impacts.
   - ❖ Include long-term impact-oriented metrics like improved resilience, water security, and **GHG** emission reductions.
2. **Leverage Technology for Real-Time Monitoring:**
   - ❖ Utilize **remote sensing**, **GIS**, and **IoT** systems to monitor environmental parameters like land use changes, water quality, and soil moisture.
   - ❖ Create centralized digital dashboards for visualizing data and improving decision-making.
3. **Foster Participatory Processes and Multi-Stakeholder Collaboration:**
   - ❖ Engage local communities in data collection and validation to reflect on-the-ground realities.
   - ❖ Facilitate collaboration among **government**, **NGOs**, **academia**, and the **private sector** to co-design and implement the **M&E** activities.
4. **Develop Baselines and Adaptive Benchmarks:**
   - ❖ Conduct baseline studies to measure pre-intervention conditions and assess progress.
   - ❖ Establish realistic and adaptive benchmarks based on emerging data and evolving climate scenarios.

5. **Institutionalize M&E Systems and Secure Funding:**

   - ❖ Form a central authority responsible for climate **M&E**, with standardized protocols for data collection, analysis, and reporting.
   - ❖ Ensure long-term funding through climate finance mechanisms and donor support to sustain **M&E** activities.

6. **Align with Global Frameworks and Best Practices:**

   - ❖ Integrate the **M&E** framework with the **SDGs** and **UNFCCC** reporting mechanisms for global alignment.
   - ❖ Adapt successful **M&E** models from other vulnerable regions to **Yemen's** specific needs and challenges.

7. **Integrate M&E Findings into Policy and Decision-Making:**

   - ❖ Use **M&E** insights to guide evidence-based policy decisions and prioritize high-impact climate projects.
   - ❖ Establish feedback mechanisms to adjust strategies based on real-time findings, ensuring that climate adaptation and mitigation efforts remain effective and responsive.

## Way Forward

To successfully implement this **M&E** framework, **Yemen** must adopt a comprehensive, inclusive, and data-driven approach that integrates technology, community participation, and cross-sector collaboration. The framework should be designed to evolve with emerging climate trends, ensuring that it remains adaptive and responsive to both short-term and long-term challenges. Key next steps include securing funding from climate finance mechanisms, **developing** capacity at local and national levels, and ensuring strong coordination between stakeholders to foster effective implementation. Regular monitoring and feedback loops will allow for the continual refinement of policies and strategies, ensuring **Yemen's** climate resilience efforts are on track. This framework will not only help **Yemen** manage its climate adaptation and

mitigation efforts but also contribute to global climate goals, reinforcing **Yemen's** role in tackling **climate change**.

# V. Strategic Recommendation for Developing an Integrated M&E Framework

Prioritize the development of a comprehensive, data-driven, inclusive, and well-resourced **Monitoring and Evaluation** (**M&E**) system that integrates the **Nexus** approach by addressing the critical interconnections between water, energy, and food security, while embedding **climate change** considerations into each of these sectors. This system should not only track **climate change** adaptation and mitigation efforts but also evaluate the synergies and trade-offs across sectors, ensuring a holistic and integrated approach. By doing so, it will inform evidence-based policies, foster cross-sectoral collaboration, and create a resilient and sustainable **development** framework for **Yemen**. The system should empower local communities, ensure equitable resource allocation, and help **Yemen** navigate its climate challenges, with a particular focus on vulnerable populations who are most affected by climate variability and extreme events. This approach will enhance **Yemen's** capacity to achieve long-term climate resilience while promoting synergies between sectors critical to **national development**.

# APPENDIX – A

# Part I: Questionnaire for Humanitarian Stakeholders:

# Nexus Approach in Yemen

This questionnaire is intended to collect feedback from humanitarian stakeholders in order to improve the execution of the Humanitarian-Development-Peace (HDP) Nexus approach in Yemen. The questions are arranged into five areas that cover the core components of Nexus programming: humanitarian assistance, development, peacebuilding, coordination, and challenges/opportunities.

## Section 1: General Information

1. **Name of Organization:** ……
2. **Type of Organization:**
   1. International NGO
   2. Local NGO
   3. UN Agency
   4. Governmental Body
   5. Donor Agency
   6. Other (please specify): ……
3. **Main Area(s) of Work:**
   1. Humanitarian Assistance
   2. Development
   3. Peacebuilding
   4. Other (please specify):
4. **Regions in Yemen Where Your Organization Operates:** ……
   ……

## Section 2: Humanitarian Assistance

1. What are the main humanitarian challenges your organization is addressing in Yemen? ……

   ……

2. Are your humanitarian programs designed with a focus on resilience and sustainability? If yes, please provide examples.

   ……

   ……

3. Do you consider local community involvement when designing and implementing humanitarian projects?

   1. Yes
   2. No
   3. Partially (please explain): ……

## Section 3: Development Programming

1. Do your development initiatives include capacity-building for local actors?

   1. Yes
   2. No
   3. Partially (please explain):

2. How are your development projects integrated with ongoing humanitarian efforts?

   ……

   ……

## Section 4: Peacebuilding

1. Does your organization implement or support peacebuilding initiatives in Yemen? If yes, please provide examples (If possible).

   ……

   ……

2. How do your programs address local-level conflicts over resources (e.g., water, land)? ……

   ……

3. Are local communities and stakeholders (e.g., tribal leaders, civil society organizations) involved in your peacebuilding efforts?

   1. Yes
   2. No
   3. Partially (please explain): ……

## Section 5: Coordination and Nexus Integration

1. What is the level of coordination between the humanitarian, development and peacebuilding sectors in Yemen today?
   1. Very well
   2. Moderately well
   3. Poorly
   4. Not at all
   5. Please explain your answer: .....

## Section 6: Challenges and Opportunities

1. What are the primary challenges your organization faces in implementing Nexus-based approaches in Yemen?

   .....

   .....
2. What opportunities exist to enhance Nexus programming in Yemen?

   .....

   .....
3. How can donor funding mechanisms better support Nexus-oriented programs?

   .....

   .....
4. What additional resources or support would help your organization adopt or expand the Nexus approach?

   .....

   .....

## Section 7: Monitoring and Evaluation

1. Does your organization have specific indicators to measure the impact of Nexus programming?
   1. Yes
   2. No
   3. If yes, please list or describe the indicators:
2. How do you monitor the long-term impact of your humanitarian or development projects?

   .....

.....

3. Do you have any recommendations for improving the design or implementation of Nexus-based programs?

.....

.....

# Part II: Climate Change Impacts and Nexus Approach in Yemen

This section focuses on understanding how climate change affects Nexus programming in Yemen and how organizations integrate climate resilience into humanitarian, development, and peacebuilding efforts.

## Section 1: Climate Change and Its Impacts

1. What are the most significant climate change impacts your organization has observed in Yemen?
   - 1. Increased drought
   - 2. Flooding and extreme weather events
   - 3. Desertification
   - 4. Water scarcity
   - 5. Other (please specify): .....
2. Are your programs directly addressing the impacts of climate change in Yemen?
   - 1. Yes
   - 2. No
   - 3. If yes, please provide examples: .....
3. How has climate change influenced displacement or migration patterns in Yemen?
   - 1. Significantly
   - 2. Moderately
   - 3. Minimally
   - 4. Not at all
   - 5. Please explain:

## **Section 2:** Climate Adaptation in the Nexus Approach

1. Does your organization integrate climate adaptation strategies into humanitarian programming?
   - 1. Yes
   - 2. No
   - 3. Partially (please explain): ……
2. Are peacebuilding efforts in your programs designed to mitigate climate-related conflicts (e.g., disputes over water, grazing land)?
   - 1. Yes
   - 2. No
   - 3. Partially (please explain): ……
3. Do you work with local communities to build capacity for climate adaptation and resilience?
   - 1. Yes
   - 2. No
   - 3. If yes, please describe your approach: ……

## **Section 3:** Challenges and Opportunities in Addressing Climate Change

1. What are the main challenges your organization faces in addressing climate change in Yemen?
   - 1. Lack of funding for climate-specific initiatives
   - 2. Limited technical expertise
   - 3. Difficulty integrating climate considerations into existing programs
   - 4. Other (please specify): ……
2. Are there specific tools or partnerships that would enhance your organization's ability to address climate change in Yemen?

   ……

   ……

## **Section 4:** Coordination on Climate and Nexus

1. Does your organization collaborate with climate-focused agencies or experts in Yemen?
   - 1. Yes
   - 2. No
   - 3. If yes, please provide details: ……..
2. How well do you think the Nexus approach in Yemen is currently addressing climate-related challenges?
   - 1. Very well
   - 2. Moderately well
   - 3. Poorly
   - 4. Not at all
   - 5. Please explain: ……

## **Section 5:** Monitoring and Evaluation of Climate Nexus Programs

1. Does your organization measure the impact of climate change adaptation activities?
   - 1. Yes
   - 2. No
   - 3. If yes, please describe the indicators used: ……
2. How do you assess the long-term climate resilience of communities supported by your programs?

   ……

   ……
3. Are there mechanisms in place to evaluate the intersection of climate resilience, development, and peacebuilding in your work?
   - 1. Yes
   - 2. No
   - 3. Partially (please explain): ……

## **Section 6:** Open Feedback on Climate and Nexus Integration

1. In your opinion, how does climate change intersect with the humanitarian, development, and peacebuilding challenges in Yemen?

   ……

   ……

2. What policy or programmatic recommendations would you make to better address climate change within the Nexus framework in Yemen?

   ……

   ……

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