LUISS

Master of International Relations

Course of EUROPEAN ISLAM: SOCIO-POLITICAL ISSUES

Strategic Climate Warfare: The Rise of Eco-Weaponization in the Middle East

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Academic Year 2024/2025

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Chapter 1: An Introduction to climate change as a new strategic frontier

1.1 Climate change as a catalyst for regional vulnerability

Climate change has become a prominent area of interest in security studies; nevertheless, its precise causal impact on conflict and instability remains contentious. Early deterministic frameworks that portrayed environmental change as a direct instigator of violence have been predominantly replaced by more advanced analytical models. Contemporary climate-security research emphasizes the notion that climate stressors operate indirectly, influencing political, economic, and institutional conditions rather than directly instigating insecurity. In this context, climate change is best understood as a catalyst that intensifies existing vulnerabilities, shaping the conditions for instability to emerge, rather than acting as a standalone cause of conflict (Sowers et al., 2020; Ide et al., 2018). This amplification logic is particularly pertinent in the Middle East and North Africa (MENA), where climatic exposure intersects with entrenched structural vulnerabilities. The region is getting warmer at a rate that could be more than 0.2°C per decade, which is almost twice the average for the whole world. Extreme heat is getting worse, and some places may become unlivable in the future (Zaouaq et al., 2024; Bourekba et al., 2021; Nasef, 2025). Along with rising temperatures, drought is a major stress multiplier. The 2006–2009 drought in Syria, which is often talked about in books, was the worst multi-year drought the country has ever had. It caused a lot of social and economic problems, like the deaths of more than 85% of livestock and the drop in wheat and barley yields of more than 50% (Ide et al., 2018; Zaouaq et al., 2024). Water scarcity worsens these problems by being both a long-term problem and a growing restriction. Some models predict that demand will rise by as much as 60% by 2045, while precipitation will decrease in some subregions (Bourekba et al., 2021; Lange et al., 2019).

One important thing Schaar's SIPRI-informed approach says is that climate change stress only makes people feel unsafe when political and institutional conditions are bad. This viewpoint asserts that climate change does not induce instability through direct causation; instead, it operates through governance capacity, state legitimacy, and institutional efficacy. When applied to MENA, this perspective embodies what has been termed a “confluence of crises,” wherein rising temperatures, water insecurity, and security pressures interact and exacerbate one another, leading to compounded effects rather than discrete environmental or political challenges (Hoffmann, 2021; Bourekba et al., 2021). Avoid double understanding is analytically crucial as it shifts attention from climatic factors solely to the political structures that shape societal responses. When governance systems are broken up, don't include everyone, or have weak state capacity, climate stress can lead to instability more easily. Environmental stress can hurt political legitimacy more easily when there is less service delivery, more intense conflicts over resources, and less trust in the government. The literature analyzed in this thesis consistently emphasizes that climate pressures undermine legitimacy and foster permissive

environments vulnerable to exploitation by extremist or coercive entities, while simultaneously cautioning against the portrayal of climate change as a primary instigator of violence (Bourekba et al., 2021; Sowers et al., 2020; Hoffmann, 2021).

The analytical strength of the amplification framework lies in its capacity to elucidate the mechanisms through which climate stress interacts with pre-existing vulnerabilities. In Syria, governance deficiencies stem from entrenched practices of political repression, rural marginalization, and development strategies that conflict with sustainable water and agricultural management (Hoffmann, 2021; Sowers et al., 2020). Instead of being outside shocks, climate stressors are part of a larger political economy of vulnerability. In this case, climate effects happen one after the other. People in rural areas have a harder time making a living when there are long periods of drought, which makes more people move to cities. Rapid urbanization puts more stress on social services that are already stretched thin, makes socio-economic problems worse, and increases tensions between state authorities and the people who are affected. These dynamics, while insufficient to exclusively clarify conflict, cultivate conditions that increase the probability of protest mobilization and instability (Ide et al., 2018; Hoffmann, 2021). Comparable dynamics are documented in other instances within the region. In Libya, climate stress coincides with persistent political instability, declining health infrastructure, inadequate surveillance capabilities, and insufficient sanitation systems, aggravating the public health and governance consequences of rising temperatures and extreme weather events (Nasef, 2025). In the Maghreb, authoritarian governance, political repression, and economic exclusion constitute pre-existing vulnerabilities intensified by climate stress, particularly through heightened poverty, unemployment, and disproportionate exposure to water scarcity (Bourekba et al., 2021; Schilling et al., 2012; Houdret, 2008).

The reviewed literature suggests that interactions between climate and fragility are best understood through cascading and interdependent effects, rather than through explanations based on individual variables. Climatic stress propagates through multiple systems—water availability, food production, public health, economic activity, social cohesion, and infrastructure—creating feedback loops that sustain vulnerability over time (Khosravi et al., 2024; Ide et al., 2018). This body of work also challenges simplistic narratives that assert a direct correlation between climate change and migration. The concept of "relative trappedness" illustrates that individuals most impacted by climate shocks may possess diminished mobility due to environmental stressors that reduce their income, assets, and mobility options (Wodon et al., 2016). From a security perspective, this dual outcome is significant: climate stress can result in both displacement that strains urban and host-community systems and immobilized deprivation that concentrates vulnerability. In both cases, people who want to use coercive control or stir up anger may be able to change these situations.

The literature analyzed in this section highlights substantial evidentiary limitations. Climate change is consistently described as a magnifier of vulnerability; however, establishing causal relationships remains methodologically intricate, and empirical findings often display correlational rather than deterministic patterns. Data scarcity, particularly in conflict-affected contexts, substantially impedes rigorous causal inference (Zaouaq et al., 2024; Hoffmann, 2021; Nasef, 2025). Even in cases that have been studied a lot, like the drought in Syria, it is said that links to climate change caused by people are possible but not proven (Ide et al., 2018).

This thesis utilizes the amplification framework as a systematic intermediary position. Climate change is deemed strategically significant not for its direct incitement of conflict, but for its capacity to reshape vulnerability landscapes, adjust governance pressures, and modify the leverage available to political and military actors. This analytical framework transcends environmental determinism and climate skepticism, establishing subsequent analysis on the dynamics between climatic stress, institutional capacity, and strategic behavior.

1.2 The Middle East's climate vulnerability

The Middle East is often thought of as one of the most climate-vulnerable areas in the world. This is not only because the area is physically vulnerable to environmental stress, but also because of the combination of persistent dryness, severe water scarcity, hydrological instability, population growth, and uneven adaptive capacity. The literature reviewed uniformly depicts regional climate insecurity as a result of structural conditions rather than discrete shocks, identifying water scarcity as the primary axis of climate vulnerability (Kelley et al., 2015; Sahour et al., 2020). Various assessments suggest that the region contains an inordinate number of the world's most water-stressed states. Twelve of the seventeen countries worldwide identified as facing extreme water stress are situated in the Middle East, where per capita water availability significantly lags behind global averages (Rezaei et al., 2024; Sahour et al., 2020; El-Fadel et al., 2001; Namdar et al., 2021). These conditions create the structural framework in which climate change acts as a vulnerability multiplier, exacerbating pressures on already limited environmental and governance systems.

Water scarcity in the Middle East is not a future projection or a temporary issue; it is a permanent structural condition. According to studies, the region's population will grow to more than 430 million by 2025, but most states are already having trouble meeting current water needs (Sahour et al., 2020). At the same time, projections show that the average annual amount of renewable water resources per person could drop to about 667 cubic meters by 2025, which is well below the commonly accepted scarcity threshold of 1,000 cubic meters (El-Fadel et al., 2001). From a security standpoint, these numbers are important because they suggest that resources will become harder to get over time, rather than just changing quickly. When resources are always scarce, people depend more on managed systems like dams, pumping stations, and desalination plants. This makes controlling infrastructure and institutional allocation mechanisms even more important from a strategic point of view.

Growing hydrological volatility makes the region's climate even more vulnerable. The literature predicts significant extensions of drought durations in extensive regions of the Middle East, coupled with diminishing precipitation during the wet season in vital upstream and headwater regions (Tabari et al., 2018; Choi et al., 2022). These changes make it harder to plan for farming, manage water in cities, and work together across state lines. The trends are already visible in the data that has been collected. By 2021, there had been big drops in river flows. The Tigris had dropped by 31%, and the Euphrates had dropped by almost 49.5% (AL-Hudaib et al., 2025). The strategic consequence of this convergence—prolonged droughts, modified precipitation patterns, and diminishing surface water availability—is that allocation decisions become progressively politicized, and competition regarding storage, diversion, and timing of releases escalates.

A key analytical finding from the literature is that water scarcity in the Middle East is often driven by demand rather than solely by climate factors. In Syria, for instance, water withdrawals are estimated to be 160 percent of internal renewable water resources, indicating unsustainable extraction practices rather than solely climatic limitations (Kelley et al., 2015). Similar trends can be seen in other places, where agricultural expansion, rising electricity demand, and broader economic development trajectories are causing consumption to grow faster than supply. Quantitative studies identify anthropogenic drivers—such as cultivated land expansion, energy production, and GDP-linked consumption—as dominant determinants of water stress (Hejazi et al., 2023; Luan et al., 2025). This differentiation is analytically significant as it contextualizes vulnerability within the framework of policy selection and political economy. Scarcity is not merely tolerated; it is generated and regulated through governance decisions, rendering it both debatable and strategically advantageous.

The literature consistently positions regional climate vulnerability within the water–energy–food nexus, emphasizing the interdependence of scarcity across sectors. When water is scarce, competition between sectors gets stronger, and energy production is often more important than farming because of its macroeconomic and geopolitical significance (Hejazi et al., 2023; Derouez et al., 2024). Agriculture is often singled out as being especially vulnerable because it relies on water and is sensitive to changes in temperature and rainfall. Several studies (Hejazi et al., 2023; Komurcu et al., 2020; Sahour et al., 2020) say that production could drop by as much as 60% by 2050 and that total revenue losses could reach more than two trillion US dollars. The nexus framework is strategically significant as it illustrates how disruption in a specific domain—such as electricity generation, fuel supply, desalination capacity, or irrigation—can produce cascading effects on food security, employment, and social stability.

The Middle East is very vulnerable to climate change because of its wide range of geography and social and economic conditions. Countries like Yemen and Djibouti are considered to be very vulnerable because they don't have many ways to adapt and their budgets are tight. On the other hand, some Gulf states are less vulnerable even though they are more exposed because they have more money and technology (Namdar et al., 2021; Mourad et al., 2025; Zaouaq et al., 2024). In the literature, certain high-risk sites keep coming up at the subnational level. For example, Syria's northeastern agricultural areas are very sensitive to drought and depend on farming for their livelihoods (Ide et al., 2018). Libya's Man-Made River system is very important to the country, but it doesn't have good sanitation (Nasef, 2025). The Gaza Strip is often called an extreme case of structural water insecurity in all possible scenarios (Feitelson et al., 2012). This discussion focuses on the pre-2023 situation, before the current phase of conflict further devastated Gaza’s water. This lack of uniformity is important for analysis because coercive leverage usually works through different levels of dependence and exposure, not through uniform scarcity.

These patterns of climate vulnerability show that scarcity in the Middle East is not just an environmental issue; it is also a political issue that depends on infrastructure. As water becomes less available, hydrological conditions become more unstable, and demand rises, the systems that control access to important resources—dams, pumping stations, desalination plants, and electricity grids—become the main way that environmental stress affects people's lives. This centrality of infrastructure has strategic consequences. When climate makes people more vulnerable, controlling environmental systems can become coercive, letting actors change

welfare, legitimacy, and bargaining dynamics by disrupting or manipulating them in specific ways. Climate vulnerability not only increases risk, but it also changes the strategic value of environmental systems themselves. This change is the analytical link to the idea of eco-weaponization, which will be explained in the next section.

1.3 Environmental stress as a strategic domain: transitioning from vulnerability to eco-weaponization

The previous sections have demonstrated that climate change in the Middle East acts as a structural amplifier of vulnerability, manifesting through chronic scarcity, institutional fragility, and infrastructural reliance. This section strengthens the argument by changing the focus of analysis from vulnerability as a state to environmental systems as sources of power. In the context of climate-induced stress, environmental resources and infrastructures have transitioned from mere background constraints or humanitarian issues to a strategic arena where political and military entities pursue coercive, military, and territorial aims. In this context, environmental stress not only intensifies the repercussions of conflict but also transforms the strategic rationale governing its execution. Scarcity, dependence, and institutional fragility convert environmental systems—especially water and energy—into leverage points that can be intentionally manipulated to affect civilian welfare, governance legitimacy, and bargaining positions. This thesis defines these practices as eco-weaponization, a strategic adaptation to environments marked by increased vulnerability and diminished buffering capacity.

Conventional perspectives in security studies and international humanitarian law have often characterized environmental degradation as a mere byproduct of armed conflict, usually rationalized under the concepts of military necessity or collateral damage. In this framework, environmental degradation is regarded as an unfortunate yet secondary consequence of violence, rather than a deliberate aim. Nonetheless, empirical trends observed in recent conflicts contest this presumption. The literature examined in this thesis illustrates that environmental resources and infrastructures are often deliberately targeted, manipulated, or withheld in manners that cannot be attributed to incidental consequences of warfare. Instead, these practices are used on purpose to control and coerce others, to weaken enemies, to keep civilians in line, or to strengthen territorial authority (Daoudy et al., 2020; von Lossow et al., 2016; Grech-Madin et al., 2025). This change is part of a larger shift in how conflicts work, as wars are moving away from big, traditional battles and toward hybrid, asymmetric, and governance-based strategies. Environmental systems are particularly appealing in this strategic context as they are crucial for civilian survival, frequently highly centralized, challenging to replace, and politically significant due to their connection with state capacity and legitimacy. Climate change makes all of these things worse by making resources harder to find, making people more reliant on managed systems, and making society less tolerant of disruption. Consequently, environmental manipulation produces disproportionate political and humanitarian consequences in relation to the resources necessary for its implementation.

Instead of putting forward a single, narrow definition, this thesis uses a group of overlapping conceptual frameworks to show how environmental systems can be used

strategically. This pluralistic approach mirrors the empirical diversity of practices and the interdisciplinary character of the literature. Daoudy et al. characterize water weaponization as the pursuit of advantage through actions employing water to kill, injure, or coerce, differentiating among modalities such as domination and legitimacy, military tool, military target, and cooperation (Daoudy et al., 2020). This typology is analytically significant as it explicitly associates environmental control with governance and political authority, rather than limiting the analysis to battlefield effects alone. Von Lossow et al. utilize a securitisation framework, categorizing practices such as the retention of flows, supply disruptions, flooding, and contamination as manifestations of weaponization when situated within security logics and political contexts (von Lossow et al., 2016). Their focus on intentionality highlights that environmental manipulation serves as a weapon not only through inflicting physical harm but also through its utilization within a strategic narrative. Grech-Madin et al. further refine this discussion by proposing a multi-dimensional framework that categorises water weaponization according to type of action (deprivation, inundation, contamination), objective (tactical versus strategic), and intensity (ranging from limited disruption to mass harm) (Grech-Madin et al., 2025). This framework is especially helpful for telling the difference between one-time acts and long-term strategies of environmental coercion. This thesis utilizes eco-weaponization as a comprehensive concept that includes the strategic manipulation of environmental resources, infrastructure, and governance mechanisms—particularly water—to coerce populations, undermine adversaries, or redefine political and territorial dominance.

A primary assertion posited in this thesis is that climate change acts as a force multiplier for eco-weaponization. Climate change does not create fundamentally new weapons; instead, it enhances the efficacy and political benefits of existing practices. The literature delineates various mechanisms facilitating this amplification. First, the decreasing baseline availability of essential resources means that even small disruptions can have big effects (Bourekba et al., 2021; Ide et al., 2018). Second, climate stress weakens the ability of households and communities to cope, making it harder to find other sources of water, diversify income, or use informal safety nets (Kohler et al., 2019). Third, higher temperatures and changes in water flow put more stress on infrastructure, making it more likely that systems will fail when they are targeted (Ashwill et al., 2013; Sahour et al., 2020). Empirical evidence indicates that in climate-stressed environments, interruptions to water or electricity supply swiftly escalate into humanitarian crises that generate immediate political pressure. A referenced study indicates that 81 percent of asylum seekers experienced water or electricity shortages in their countries of origin, highlighting the significance of environmental deprivation as a catalyst for insecurity and displacement (Kohler et al., 2019). Climate change increases the "return on investment" of environmental coercion by making its social, political, and psychological effects stronger.

The literature reviewed indicates that water is the most commonly weaponized environmental resource. In systematic reviews of environmental manipulation, water is present in the vast majority of recorded instances, highlighting its significance in current conflict dynamics (von Lossow et al., 2020). This prominence is a result of both material and political factors. Water is essential and mostly irreplaceable in dry and semi-dry areas. Politically, water infrastructure like dams, canals, and pumping stations is usually controlled by the state and is seen as a symbol of sovereignty, development, and authority. Climate change makes these situations worse by making people more reliant on regulated flows and less redundant.

The Syrian conflict offers numerous documented instances of water weaponization, encompassing threats to obliterate infrastructure, intentional inundation of arable land, and selective denial of access impacting millions of civilians (Daoudy et al., 2020; von Lossow et al., 2020). The capture of major dams in the Tigris–Euphrates basin made it possible to change water flows in a more planned and long-lasting way. This shows how infrastructure scale can give you more strategic power (Muralidharan et al., 2024). Water weaponization is not just about destroying things, which is an important point. Under climate stress, when small changes can have big effects, subtler practices like putting off maintenance, changing the timing of releases, or only enforcing access rules on certain people are often more effective.

The literature records eco-weaponization by both state and non-state entities, contesting the notion that environmental manipulation is predominantly a strategy of irregular forces. Upstream states might use hydrological control as a bargaining chip in larger security or diplomatic conflicts. Turkey's connection of Euphrates water releases to Syria's cooperation against the PKK is often used as a clear example of this kind of strategic conditionality (Muralidharan et al., 2024). Non-state actors have also included environmental control in their plans. The Islamic State is characterized as a methodical practitioner of water weaponization, integrating the management of dams and pumping stations into extensive initiatives of territorial administration and population regulation (von Lossow et al., 2020). The literature also points out an important limitation: people who want to be seen as legitimate have reasons to provide only the bare minimum of services. This shows that environmental systems can be both tools of coercion and valuable assets for governance. Climate change makes both groups of actors more likely to act. For states, growing scarcity makes controlling upstream more important. For non-state actors, climate-induced deprivation diminishes the cost of coercion compared to traditional violence. This convergence indicates that eco-weaponization is likely to endure and possibly escalate—in a warming region.

While water prevails in current scholarship, the reviewed literature also highlights novel forms of eco-weaponization beyond hydrology. Energy infrastructure is increasingly targeted because it is so important for providing water, healthcare, storing food, and cooling off (Ashwill et al., 2013). Environmental governance can also be used as a way to force people to do something. Selective denial of disaster relief, manipulation of humanitarian access, and exclusion of marginalized populations from recovery efforts turn environmental crises into tools for political control. Myanmar's management of Cyclone Nargis and COVID-19 relief has been referenced as an instance of disaster weaponization via governance mechanisms (Passeri, 2022). These dynamics place eco-weaponization within larger contexts of hybrid warfare. Chiragov et al. define environmental threats as non-kinetic tools that obscure the distinction between war and peace, underscoring the strategic significance of environmental manipulation in modern security competition (Chiragov et al., 2025).

1.4 Goals and contributions of the research

This thesis investigates strategic climate warfare by analyzing eco-weaponization in the Middle East, positioning the intentional alteration of environmental systems at the convergence of

climate change, conflict dynamics, and regional geopolitics. A significant corpus of research has examined climate change as a catalyst for instability, fragility, and governance strain, alongside an emerging body of literature that records instances of environmental manipulation in conflict scenarios; however, these domains of inquiry remain only partially interconnected. The primary objective of this research is to reconcile this disparity by examining how climate-induced vulnerability alters the strategic rationale of coercion, converting environmental systems from mere constraints into instruments of power.

The thesis begins with the premise that environmental resources, particularly water and energy infrastructures, are increasingly exploited for strategic purposes in armed conflicts and coercive negotiations throughout the Middle East. Current research offers substantial empirical evidence of such practices, frequently through comprehensive case studies or sector-specific perspectives, particularly concerning the militarization of water resources (Daoudy et al., 2020; von Lossow et al., 2016; Grech-Madin et al., 2025). Simultaneously, climate-security scholarship has predominantly framed climate change as a contextual risk factor that exacerbates fragility, migration pressures, and governance challenges, rather than as a condition that actively transforms strategic behavior (Sowers et al., 2020; Hoffmann, 2021; Bourekba et al., 2021). The principal research issue examined in this thesis resides at the confluence of these two bodies of literature. Climate change and environmental stress are often examined separately from strategic interaction, regarded as external pressures that influence outcomes without modifying the strategic considerations of actors. Conversely, environmental manipulation is frequently analyzed as a humanitarian, legal, or ethical issue, rather than as a calculated form of coercion integrated within regional power dynamics and strategic behavior theories. This analytical division results in two interconnected deficiencies. First, climate change and eco-weaponization are usually looked at separately, not as two things that work together to make each other stronger. Second, the strategic rationale for environmental manipulation is still not fully developed, especially when it comes to how climate-induced scarcity, dependence, and institutional weakness make these practices more effective and appealing.

The thesis addresses this issue by pursuing four interconnected research objectives. First, it aims to identify and organize patterns of eco-weaponization in the Middle East. Utilizing established typologies of water and environmental weaponization, the study delineates recurring methodologies—such as deprivation, inundation, and infrastructure seizure—alongside their objectives (tactical versus strategic) and primary targets, including civilian populations, agricultural systems, and urban infrastructure (Daoudy et al., 2020; Grech-Madin et al., 2025; von Lossow et al., 2020). The thesis examines these practices not as isolated or opportunistic, but as integral elements of broader strategic repertoires utilized in contexts of environmental stress. Second, the thesis contextualizes eco-weaponization within the geopolitical and hydropolitical frameworks of the Middle East. This study builds on analyses of transboundary resource interdependence and asymmetric power relations to examine how upstream–downstream configurations, infrastructure centralization, and uneven adaptive capacity influence opportunities for environmental coercion (Kibaroglu et al., 2021). This goal directly addresses calls in the literature for greater integration between studies of environmental security and analyses of regional power. Third, the thesis explicitly analyzes climate change as an amplifier of strategic efficacy. While existing scholarship recognizes that climate stress intensifies vulnerability, this research examines how increasing scarcity, hydrological

instability, and infrastructural pressure modify cost–benefit assessments for both state and non-state entities, thereby enhancing the coercive efficacy of environmental manipulation (Bourekba et al., 2021; Ide et al., 2018; Kohler et al., 2019). In this way, it changes the way we think about climate change, not just as a risk but as a situation that changes strategic incentives and behavior. Fourth, the thesis assesses the inadequacies of current legal and institutional responses to eco-weaponization. International humanitarian law and environmental protection norms forbid attacks on civilian infrastructure, but enforcement is still uneven, especially in places where sovereignty is divided and non-state actors are present (Daoudy et al., 2020; von Lossow et al., 2020; Gama et al., 2023). The study investigates how climate change exacerbates accountability issues by obscuring the boundaries between intentional manipulation and systemic deterioration, consequently generating governance and legal deficiencies.

These objectives are implemented through four guiding research questions: How and under what circumstances are environmental resources and infrastructures militarized in the Middle East? How does climate change make environmental manipulation more useful for strategy and more effective for coercion? How do geopolitical imbalances in a region and dependencies across borders affect the use of eco-weapons? How much do current laws and institutions limit or don't limit strategic climate warfare? These questions collectively organize the empirical analysis, ensuring a distinct emphasis on strategic logic rather than merely descriptive results.

This thesis makes a contribution that is both empirical and theoretical. The thesis empirically consolidates and systematizes evidence regarding eco-weaponization in various Middle Eastern contexts, incorporating case studies on the manipulation of water, energy, and infrastructure that are frequently scattered across distinct literatures. By placing these practices within a context of climate-enhanced vulnerability, the research offers a more integrated explanation of the timing, mechanisms, and motivations behind environmental coercion. The thesis conceptually enhances climate-security scholarship by recontextualizing climate change as a strategic condition rather than a mere background risk factor. It enhances environmental security studies by integrating eco-weaponization into frameworks of coercion, asymmetric interdependence, and hybrid warfare, thus transcending primarily humanitarian or legal perspectives (Chiragov et al., 2025; Passeri, 2022). More generally, the thesis presents strategic climate warfare as an analytical framework that encapsulates the strategic utilization of environmental susceptibility in a warming, resource-limited context. This idea doesn't mean that using environmental harm in a new way; instead, it points out a change in strategic importance caused by climate change, reliance on infrastructure, and weak governance.

Finally, it is important to make clear what this research is about and what it is not. The thesis does not assert that climate change induces conflict, nor that eco-weaponization is an unavoidable consequence of environmental stress. Instead, it looks at certain situations—scarcity, dependence, and weak institutions—when manipulating the environment becomes a good strategy. The thesis also does not try to give a complete legal analysis of environmental protection systems. Instead, it focuses on the practical limits of current frameworks in modern conflicts. This analytical discipline is crucial to prevent exaggeration and to guarantee that eco-weaponization is regarded as a contingent, albeit progressively significant, aspect of regional security dynamics.

Chapter 2: Theoretical and conceptual framework

2.1 Defining eco-weaponization and related concepts

Eco-weaponization occupies an ambiguous and contested position within the broader climate-security and conflict literature. Environmental factors have long been acknowledged as pertinent to security dynamics; however, the intentional manipulation of environmental systems as tools of coercion is still inadequately conceptualized. This ambiguity illustrates the interdisciplinary character of the field, encompassing international relations, environmental security studies, public health, geography, and international law, as well as enduring analytical uncertainty regarding the demarcation between environmental harm and environmental strategy. A significant portion of the literature concerning the environmental aspects of conflict has traditionally concentrated on scarcity, degradation, or climate stress as underlying factors influencing instability. In these frameworks, environmental damage is frequently regarded as either an external shock or a collateral effect of political violence. Eco-weaponization, on the other hand, focuses on the intentional use, control, or manipulation of environmental systems to gain political, military, or social power. The difficulty resides not in acknowledging the significance of environmental systems for security, but in delineating the circumstances in which they operate as tools of coercion rather than as passive casualties of conflict. In general, eco-weaponization means using environmental resources, infrastructures, or processes in a planned way to limit enemies, control populations, or change bargaining positions. Nevertheless, the extent of this concept significantly differs throughout the literature. Some writers use narrow definitions that limit eco-weaponization to obvious acts of war, like destroying dams or purposely contaminating water supplies. Others use wider definitions that include practices that are indirect, cumulative, or built into the structure, even if they happen when there is no open warfare. Duarte Lopes et al. (2025) make a significant contribution to this debate by defining water weaponization as a broad array of coercive practices in various conflict scenarios, such as interstate war, civil conflict, terrorism, civil unrest, and domestic political violence. This framework does not restrict weaponization to kinetic actions; instead, it positions environmental manipulation on a spectrum of conflict intensity, encompassing both explicit violence and more nuanced forms of coercion inherent in governance structures and infrastructure management. This methodology is particularly pertinent for examining modern conflicts, wherein coercion often functions beneath conventional thresholds of warfare. This more general idea is based on earlier work by Gleick, who made a three-part typology that separates water into three categories: as a cause of conflict, as a weapon of conflict, and as a victim of conflict (Gleick et al., 2023). Gleick's framework effectively contested the notion that environmental systems are merely collateral victims of violence, instead illustrating that water has consistently served as an active element in conflict strategies throughout history. Gleick's typology offers a crucial empirical basis, yet it fails to address significant inquiries concerning intentionality and strategic objectives. To overcome these constraints, Paula Duarte Lopes et al. amalgamate Gleick’s classifications with King’s typology, which distinguishes among strategic, tactical, unintentional, and psychological modalities of water weaponization.

This distinction facilitates a more nuanced analysis of the functioning of environmental manipulation across varying levels of intent and impact. Strategic weaponization is when you try to change the political or territorial outcome in the long term by controlling the environment. Tactical weaponization, on the other hand, is when you try to gain a short-term military advantage. Psychological weaponization, on the other hand, focuses on signaling, fear, and compliance with behavior, even when there is no ongoing physical disruption. The issue of intentionality persists as a pivotal point of contention in definitional discussions. Some academics contend that eco-weaponization ought to be limited to instances where the intention to coerce via environmental manipulation is evident. From this viewpoint, broadening the concept to encompass unintended environmental harm jeopardizes analytical precision and diminishes legal accountability. Reininghaus et al. (2019) draw a clear line between intentionally contaminating water systems, which they call terrorism, and environmental damage that happens when infrastructure falls apart or is ignored. This distinction is especially important in legal settings, where proving intent is more important than proving the outcome. Some areas of scholarship take a more outcome-based approach, focusing on the effects of environmental damage on people and things, regardless of the intent. Public health research often examines the cascading effects of water infrastructure damage on disease transmission, displacement, and humanitarian crises, even when establishing intentionality is challenging (A. Abbara et al., 2021). In climate-stressed environments marked by infrastructural fragility and constrained redundancy, indirect or negligent actions may yield consequences akin to intentional attacks.

The distinction between intent-based and impact-based definitions signifies varying analytical priorities rather than conflicting interpretations. Several scholars contend that eco-weaponization ought to be classified within the overarching framework of environmental warfare. Herndon et al. (2020) define environmental warfare as the intentional alteration of natural systems, encompassing atmospheric and climatic processes, for strategic or military objectives. Rosenbaum's earlier definitions of environmental warfare also said that it was the use of environmental modification techniques, like defoliation or artificial flooding, to reach coercive goals. Although these strategies originated during the Cold War, they continue to be pertinent to current discussions regarding geoengineering, climate intervention, and dual-use environmental technologies. Motive-based frameworks enhance the conceptual landscape. Schillinger et al. (2020) delineate the political, tactical, and psychological aspects of water weaponization, emphasizing how environmental control can facilitate governance consolidation, military operations, or behavioral manipulation. The psychological aspect is especially important because it shows that coercion doesn't always need to involve physical disruption. Just showing that you have control over important resources can make civilians less confident, less resilient, and more likely to obey because they expect it to happen rather than because they are forced to. These debates show that eco-weaponization can't be boiled down to one type of actor, mechanism, or time period. It includes a wide range of actions, from openly destroying infrastructure to using legal systems, governance structures, and long-term development plans to control the environment. Instead of giving a narrow definition, the analytical job is to make clear how different kinds of environmental manipulation work in terms of intent, scale, and power imbalance. This thesis employs a comprehensive yet analytically rigorous definition of eco-weaponization as the strategic employment, manipulation, or

domination of environmental systems—via direct violence, infrastructural supremacy, or institutional frameworks—to exert coercive influence over states, populations, or political results. This definition maintains an awareness of intentionality while acknowledging that, in the context of climate stress and infrastructural dependence, indirect and structural forms of environmental coercion can be as strategically significant as overt attacks.

2.2 Domination, cooperation, and the coercive spectrum of environmental power

Much of the early writing on environmental security thought of cooperation and conflict as two different and incompatible results of not having enough resources. In this binary framework, environmental stress was anticipated to either incite violent competition or to encourage collaborative governance structures designed to alleviate collective risks. Although this dichotomy is analytically compelling, it has faced growing scrutiny from scholars who contend that cooperation can yield coercive outcomes, especially in contexts characterized by asymmetrical power dynamics. Daoudy's framework of domination and cooperation is a key contribution to this discussion. Instead of seeing domination and cooperation as opposites, Daoudy sees them as two sides of the same coin that can be used to get leverage, limit, or force in environmental politics (Duarte Lopes et al., 2025). This methodology is especially pertinent for examining eco-weaponization, as it elucidates the mechanisms by which environmental power can be exerted not solely through explicit violence or unilateral measures, but also through institutionalized frameworks that perpetuate unequal dynamics over time.

2.2.1 Water as domination

In Daoudy's framework, domination denotes scenarios wherein control over water resources or infrastructure is utilized to impose limitations on other entities, generally through enduring asymmetries rather than transient confrontations. Domination does not inherently depend on overt acts of violence. Instead, it works by keeping control over flows, storage space, and decision-making power for a long time. This lets powerful actors shape vulnerability and dependency downstream (Paula Duarte Lopes et al., 2025). Hydro-hegemony scholarship bolsters this viewpoint by highlighting that coercion frequently arises from structural mechanisms rather than isolated incidents. Hayat et al. (2022) argue that water-related power is frequently exercised through infrastructural dominance, legal frameworks, and technical expertise, which together enable upstream actors to consolidate advantage without resorting to militarised force. In these situations, domination becomes a part of everyday governance, making coercive results less obvious but still very important. Empirical examples of water as a means of control can be found in many places. Adel (2013) elucidates how India's construction and operation of the Farakka Barrage modified hydrological conditions downstream in Bangladesh, resulting in enduring ecological and socio-economic repercussions without manifesting as an overt act of hostility. In the Israeli–Palestinian context, enduring disparities

in water access have been influenced by military occupation, infrastructural control, and regulatory frameworks that consistently favor Israeli users over Palestinian communities (Krystel Wanneau et al., 2010). These instances illustrate that domination functions through cumulative effects rather than through dramatic acts of destruction. From an eco-weaponization standpoint, domination is analytically pertinent as it underscores modalities of environmental coercion that endure despite the absence of armed conflict. Environmental systems become tools of power because they are necessary, hard to replace, and not always well-managed. Dominant actors can affect people's lives, where they live, and how they vote for long periods of time by controlling these systems.

2.2.2 Water as cooperation

Daoudy's framework does not regard cooperation as inherently beneficial. Instead, it looks into the situations in which cooperative arrangements either reproduce or lessen existing power imbalances (Paula Duarte Lopes et al., 2025). Cooperation becomes problematic when it arises in contexts of unequal bargaining power, constrained alternatives, or structural dependence, compelling weaker parties to acquiesce to arrangements that perpetuate disadvantage rather than foster mutual benefit. In these instances, cooperation serves not as a means of collective governance but rather as a stabilizing mechanism for unequal results. Hayat et al. (2022) assert that cooperative institutions can institutionalize power disparities by integrating them into treaties, joint commissions, or technical standards that, while ostensibly neutral, limit the policy options available to less powerful entities. The lack of overt coercion does not negate coercive effects; instead, it obscures them and complicates opposition. This dynamic is especially clear when environmental diplomacy uses issue-linkages or benefit-sharing stories that hide unfair distributions. Sakal et al. (2022) illustrate that cooperative environmental initiatives in the South Caucasus, ostensibly designed as confidence-building measures, have resulted in outcomes that disproportionately advantage dominant actors. Cooperative discourse exists alongside material arrangements that compromise regional equity and resilience. From the viewpoint of eco-weaponization, the importance of cooperative coercion resides in its resilience. Cooperative arrangements can create long-term asymmetric dependence, which makes systems more vulnerable to short-term political change. This is different from episodic attacks on infrastructure. Environmental systems become instruments of leverage not via disruption, but through standardized governance.

2.2.3 Why the domination–cooperation distinction matters for eco-weaponization

Putting domination and cooperation on the same coercive spectrum has important effects on how we study eco-weaponization. Narrow definitions that equate weaponization solely with physical attacks may neglect coercive outcomes arising from institutional arrangements, regulatory frameworks, and infrastructural design (Paula Duarte Lopes et al., 2025; S. Hayat et

al., 2022). This insight is especially pertinent for comprehending environmental manipulation in scenarios characterized by sporadic violence or significant political repercussions. Instead, coercion can happen by not providing maintenance, changing access rules, or only enforcing technical standards in certain situations. These actions may never be seen as "attacks," but they systematically weaken resilience and limit freedom. The domination-cooperation framework also facilitates theoretical integration among disparate literatures. Duarte Lopes et al. (2025) contend that eco-weaponization research is hindered by an insufficiently developed link between "water wars" and "water weaponization" scholarship. By utilizing Daoudy's distinction, they offer an organizational framework that harmonizes event-centric analyses with structural power methodologies. Domination encapsulates enduring asymmetry, whereas cooperation elucidates the processes through which this asymmetry is institutionalized and normalized.

2.2.4 Implications for this thesis and the Middle East focus

The domination–cooperation framework is especially useful for a thesis about strategic climate warfare in the Middle East. In the region, environmental coercion often manifests without overt hostilities, functioning through asymmetric reliance on transboundary water systems and centralized infrastructure (Paula Duarte Lopes et al., 2025). This framework allows for the conceptualization of eco-weaponization as a continuum, extending from overt infrastructural assaults to more subtle forms of domination integrated within negotiation processes and governance frameworks (Paula Duarte Lopes et al., 2025; S. Hayat et al., 2022). It also fits with bigger criticisms in the literature that say dominant frameworks tend to downplay the social, cultural, and political aspects of hydro-politics and the role of outside actors in shaping environmental outcomes (S. Hayat et al., 2022). In this regard, Daoudy's differentiation is not solely descriptive. It offers the conceptual link necessary to relate environmental manipulation to the following chapters on infrastructure targeting, hydro-hegemony, and hybrid warfare. By emphasizing how coercion can function within both contentious and collaborative environmental politics, the framework enables the thesis to examine eco-weaponization as a structurally ingrained strategy rather than a sporadic occurrence.

2.3 Gleick's typologies and the constraints of event-based methodologies in eco-weaponization

Peter Gleick's research is one of the most important sources for studying water and conflict. It still has an impact on modern research on eco-weaponization. His tripartite typology — differentiating water as a catalyst of conflict, a tool of conflict, and a victim of conflict — has been extensively utilized as an operational framework for the identification and classification of water-related violence throughout historical epochs and geographical settings (Gleick et al., 2023). The lasting impact of this framework demonstrates its conceptual clarity and empirical relevance. The Water Conflict Chronology is a systematic database that, as of 2022, records

1,298 water-related conflict events from around 2400 BCE to the present (Gleick et al., 2023). This is a key part of Gleick's work. The Chronology has shown that violence related to water is not rare or random, but a regular part of political conflict by coding events that involve water infrastructure, access, and control. This empirical foundation has facilitated longitudinal comparison and cross-case analysis that were formerly limited by disjointed historical records.

2.3.1 Analytical contributions of Gleick's framework

Gleick's typology provides numerous significant analytical benefits. First, it introduces conceptual differentiation by clarifying the multiple roles water can play within conflict dynamics, thereby avoiding overly generalised narratives of "water wars" (Gleick et al., 2023). By separating triggers, weapons, and victims, the framework helps analysts figure out if water is a cause, a tool, or a victim of violence in a certain situation. Second, the typology makes water-related conflict more visible by turning qualitative reports into events that can be coded. This operationalization has been especially useful for policy-oriented research, risk assessment, and early-warning initiatives because it makes it possible to systematically track patterns of water-related violence over time (Gleick et al., 2023). The Chronology's accessibility has also made it easier for people from different fields to work together, bringing together academic research with practitioners and policymakers. The framework has been utilized in various contemporary conflicts. In the Russia–Ukraine war, water systems have acted as defensive barriers, strategic assets, and deliberate targets, showing that Gleick's distinctions are still important in high-intensity interstate conflict (Gleick et al., 2023). Gleick's typology has influenced examinations of infrastructure targeting in Syria and Iraq, aiding in the documentation of the utilization of water systems to apply military pressure and dominate civilian populations (Abbara et al., 2021). Schillinger et al. (2020) further develop Gleick's framework by employing the distinction between discriminate and indiscriminate destruction to elucidate why water infrastructure is especially appealing to terrorist organizations. Because water is so important for civilians to survive and is a symbol of state power, attacks on water systems have effects on people that are much worse than what would happen if they weren't there. Public health research also uses Gleick's typology to look at how damage to water infrastructure can lead to more disease spread, people moving, and deaths (Abbara et al., 2021).

2.3.2 Structural and conceptual limitations

Even with these contributions, an increasing amount of research points out major flaws in Gleick's typology, especially when it comes to long-lasting conflicts and situations where the structure is unbalanced. Gleick himself admits that there are problems with interpretive bias, underreporting, and figuring out what caused the Water Conflict Chronology (P. Gleick et al., 2023). These problems aren't just technical; they show that event-based approaches have deeper conceptual limits. A principal constraint resides in the typology's emphasis on distinct, observable events. Gleick's framework gives more weight to episodic acts of violence than to slower, cumulative processes by coding identifiable events like attacks on dams or planned

flooding. Duarte Lopes et al. (2025) assert that this focus may neglect coercive mechanisms manifested through infrastructural neglect, institutionalized access limitations, or regulatory frameworks that systematically disadvantage specific demographics. These actions could have serious political and humanitarian effects without creating a single "event" that can be coded. This limitation is especially important when environmental coercion works by making things disappear instead of doing something. Blockades, maintenance denial, or the manipulation of technical standards may erode resilience and welfare over time, yet remain analytically invisible within event-based datasets (Duarte Lopes et al., 2025). In climate-stressed settings, where infrastructure functions at near capacity and redundancy is constrained, these indirect methods of manipulation can be as significant as direct assaults.

2.3.3 Intentionality and the attribution problem

A second major critique concerns intentionality. Gleick's typology fails to systematically distinguish between intentional weaponization and inadvertent environmental damage, categorizing both under the general terms "weapon" or "casualty" (Gleick et al., 2023). This inclusiveness facilitates extensive data collection but complicates analytical endeavors aimed at discerning coercive intent and strategic calculation. Intentionality is crucial in assessing whether environmental damage serves as a weapon or merely as a consequence of violence, as emphasized in the extensive eco-weaponization literature (Reininghaus et al., 2019). Event-based methodologies often fail to delineate this distinction, as intent is frequently ambiguous, disputed, or reconstructed in hindsight. This issue is especially important in legal and normative analyses, where accountability depends on showing purpose rather than consequence. The challenge of assigning intent is compounded by climate-induced degradation and infrastructural vulnerability. When environmental systems are already under stress, it can be hard to tell the difference between intentional manipulation and systemic failure. This can lead to confusion that both state and non-state actors may try to take advantage of.

2.3.4 Power asymmetry and scale blindness

Another criticism pertains to scale. Gleick's framework primarily functions at the level of individual incidents, making it less attuned to basin-wide power asymmetries and long-term structural domination. Hydro-hegemony scholars contend that water-related coercion is often implemented via persistent control over flows, infrastructure, and legal frameworks, rather than through sporadic violence (Hayat et al., 2022). In these situations, the most important types of eco-weaponization might not show up as conflicts, but they do have a big effect on vulnerability and political power. This dynamic is especially clear in the Middle East, where upstream control, infrastructure dominance, and institutional weakness work together to create uneven results that last even when there is no open conflict (Hayat et al., 2022). Event-based datasets are inadequately designed to encapsulate these types of structural coercion.

2.3.5 Toward theoretical integration

Acknowledging these constraints, contemporary scholarship advocates not for the rejection of Gleick's typology, but for its amalgamation with supplementary analytical frameworks. Duarte Lopes et al. (2025) contend that eco-weaponization research is hindered by an insufficiently theorized distinction between the literatures of "water wars" and "water weaponization." To fill this gap, they suggest putting together Gleick's event-based categories, Daoudy's domination-cooperation spectrum, and King's intentionality dimensions. This integrative method keeps the empirical strengths of Gleick's framework while filling in the gaps in its ideas. Gleick's typology offers historical depth and operational clarity; domination-cooperation analysis elucidates long-term structural coercion; and intentionality frameworks clarify strategic objectives. These tools, when used together, help us understand eco-weaponization better as both an event-driven and systemically embedded phenomenon (Duarte Lopes et al., 2025; Hayat et al., 2022).

2.3.6 Relevance

The constraints of event-based typologies are especially significant for a thesis centered on strategic climate warfare in the Middle East. In the region, environmental coercion often manifests through control of infrastructure, regulatory frameworks, and cumulative degradation, rather than isolated acts of destruction (Abbara et al., 2021; Hayat et al., 2022). Consequently, although Gleick's framework serves as an essential empirical foundation, it is inadequate by itself to encompass the complete spectrum of coercive mechanisms in operation. Consequently, this thesis regards Gleick's typology as an initial framework rather than a conclusion, situating it within a more extensive conceptual framework that emphasizes power asymmetry, institutionalized domination, and strategic intent. This integrated approach facilitates the analysis to progress from merely cataloguing incidents to elucidating the transformation of environmental systems into instruments of strategic leverage amid climate stress and political conflict (Duarte Lopes et al., 2025).

2.4 Historical genealogies of environmental manipulation

While current discussions frequently characterize eco-weaponization as a recent outcome of climate change, technological progress, or contemporary infrastructure, the strategic manipulation of environmental systems possesses profound historical origins. Environmental considerations have been incorporated into military strategy, statecraft, and authoritarian governance for an extended period, predating the advent of contemporary climate science and large-scale industrial technologies. Tracing these historical genealogies is analytically significant not to imply continuity in form or scale between past and present practices, but to

illustrate that the intentional exploitation of environmental systems for strategic advantage is a persistent characteristic of conflict rather than an unprecedented anomaly. Early historical instances demonstrate that environmental manipulation has served as both a tactical and strategic tool, especially in scenarios where dominance over natural systems could significantly affect political or military results. Classical Chinese texts record the utilization of flood-based warfare during the Zhou Dynasty in the fifth century BCE, employing the diversion of rivers and the demolition of dikes to inundate adversarial territories, disrupt agricultural output, and diminish opposing forces. These practices show that people knew early on that hydrological systems could be used as weapons of coercion to cause large-scale disruption without direct conflict between armed forces. These actions were not just bad for the environment; they were also planned moves based on factors like terrain, timing, and the safety of civilians. Flood warfare aimed to weaken the material bases of resistance by attacking agricultural land and settlement areas instead of enemy troops directly. These instances illustrate that environmental manipulation has been employed historically to exert indirect pressure on opponents by altering survival conditions rather than depending exclusively on direct combat (Chen et al., 2012). Similar dynamics are observable in historical narratives of the Sasanian Empire in the fourth century CE. The Sasanians built advanced hydraulic engineering systems along the Euphrates that let them control the flow of water for both defense and attack. The state could protect cities that were important to its strategy, deny enemies water, and affect where people settled by controlling canals and irrigation networks. These actions were not random side effects of war; they were part of a larger plan to connect environmental control to political power and land management (Farrokh, 2023). These early cases together show two things that will always be true about environmental manipulation. First, these kinds of actions have often hurt civilian livelihoods, especially farming and settlement, instead of just military forces. Second, they have depended on differences in knowledge, location, or control over environmental systems, which is similar to how power and infrastructure work today, with upstream and downstream power. Environmental coercion is not an anomaly but a historically entrenched method of exerting power in conditions of asymmetry.

2.4.1 From tactical intervention to structural control

In the past, environmental manipulation often meant making small changes that only happened once or in a small area. In the modern era, however, there has been a major shift toward structural and systemic forms of environmental control. The growth of big hydraulic systems, industrial farming, and interconnected energy networks changed environmental manipulation from a short-term strategy to a long-term tool for control and governance. This change is important for understanding how eco-weaponization works today because it puts modern practices in the context of a larger historical change from environmental events to environmental systems as sources of power. Conflicts in the twentieth century show this change in many ways. One of the most often mentioned examples is when the Iraqi government purposefully drained the Mesopotamian Marshes in the late 1900s. This intervention permanently changed a complicated ecosystem that had supported local economies and given

shelter to people who were politically marginalized. The destruction of the marshes was not just for a short-term military goal; it was also a way to control territory and population over the long term in order to stop resistance and weaken independent social and environmental systems. This case exemplifies how environmental manipulation can operate simultaneously as environmental destruction, population control, and political repression. It also shows how deeply modern eco-weaponization is ingrained in government practices, not just in times of war (Adriansen, 2004). Environmental systems are targeted not for their immediate tactical significance, but for their function in preserving social order, economic operations, and political independence. Such actions make it hard to tell the difference between how people act during war and how they act during peace. Environmental manipulation can occur via development initiatives, infrastructural reconfiguration, or regulatory choices that, while not officially classified as armed conflict, yield coercive results akin to military action. This ambiguity makes it harder to put things into legal and normative categories because it questions the usual lines between war, peace, and governance.

2.4.2 Historical continuity and analytical consequences

The historical record shows that people have changed the environment many times in places where the lines between war and peace are not clear. Environmental systems have been used to apply pressure, control populations, and strengthen authority in indirect ways, from ancient flood warfare to modern infrastructure re-engineering. Although modern eco-weaponization varies in scale, technological advancement, and legal framework, its strategic rationale is not unprecedented. This section situates eco-weaponization within its historical genealogies, thereby reinforcing the argument that environmental systems have long been integral to strategies of coercion and control. Modern practices ought to be examined not as discrete innovations, but as modifications of persistent strategic logics to novel technological, environmental, and political contexts.

2.5 Infrastructure, coercion, and environmental terrorism

One of the most important ways that eco-weaponization shows up in modern conflicts is through the strategic targeting of environmental infrastructure. Earlier research on environmental security mostly looked at resource scarcity as a background factor that caused instability. More recent research shows that water, energy, and agricultural infrastructures are becoming more and more direct tools of coercion. These systems are no longer perceived as mere collateral damage of war; rather, they are understood as deliberately integrated elements of conflict strategies designed to erode civilian resilience, undermine territorial control, and weaken political authority. This change is due to both changes in the material world and changes in strategic thinking. Environmental infrastructures are usually centralized, fixed in one place, and very important for civilian survival, which makes them easy to manipulate. Weinthal and

Sowers note that modern conflicts are more likely to happen when systems that keep people alive are broken than when there is a clear battle. In this context, the targeting of infrastructure obscures traditional boundaries between military and civilian spheres, as coercion is implemented via the regulation of access to essential services rather than through direct confrontation with armed forces.

2.5.1 Environmental infrastructure as a strategic target

Three types of environmental infrastructure are often used as eco-weapons in the literature: water systems, energy facilities, and agricultural assets. Water infrastructure is the most commonly weaponized of these because it is so important for public health, food production, and the legitimacy of the state. During the war, major dams on the Euphrates and Tigris rivers in both Syria and Iraq became strategically important because controlling them gave armed groups power over water availability, electricity generation, and population movements. For example, when ISIS took over the Tabqa Dam, it had a direct effect on the water and power supplies of millions of civilians. This shows how controlling infrastructure can give you a lot of power (Daoudy et al., 2020). Similar dynamics are observable in Iraq, where the capture of the Fallujah Dam facilitated the intentional release of water that flooded downstream regions, resulting in the destruction of roughly 160 kilometers of agricultural land and the displacement of civilian populations (Damluji et al., 2016). These instances illustrate that the weaponization of water infrastructure does not function exclusively through deprivation. Controlled excess, especially flooding, can be used as a way to force people to do things, turning a lot of water into a source of harm. Energy infrastructure shows similar patterns of strategic targeting. Attacks on oil and gas facilities have been planned and carried out in order to hurt the environment and hurt the economy and government in the long term. During its retreat from Iraqi territory, ISIS deliberately set fire to oil fields, burning an estimated 1.33 million barrels of oil over 267 days (Bulmer et al., 2018). These actions harmed the environment, slowed down the recovery of the economy, and made it harder for post-conflict governance structures to work. Agricultural systems constitute a third, and often less explicitly acknowledged, dimension of environmental coercion. The destruction of irrigation networks, contamination of arable land, and obstruction of farming activities directly compromise food security and rural livelihoods. In multiple Middle Eastern conflicts, such practices have contributed to forced displacement and demographic reconfiguration, underscoring the strategic value of agriculture as a target of eco-weaponization.

2.5.2 Direct attacks and indirect forms of degradation

A central analytical distinction in the literature concerns the difference between direct attacks on environmental infrastructure and indirect forms of infrastructural degradation. Direct attacks involve immediate physical destruction through airstrikes, bombing, sabotage, or armed seizure, producing rapid and visible disruption. Indirect degradation, by contrast, operates

through blockades, denial of maintenance, contamination, or regulatory obstruction, generating cumulative harm over extended periods. Direct attacks typically produce immediate humanitarian consequences and attract significant international attention. In Syria, for example, airstrikes conducted by both state and non-state actors reduced access to safe drinking water by approximately 50 percent in affected areas (Abbara et al., 2021). Russian bombing of the al-Khafsa water treatment facility and repeated strikes on pumping stations illustrate how targeted attacks can rapidly collapse essential services, triggering public health crises and displacement (Abbara et al., 2021). Indirect degradation, however, often proves more strategically durable. The prolonged blockade of Gaza illustrates how restrictions on construction materials, fuel, and maintenance inputs can render infrastructure inoperable without overt destruction. As a result, over 92.6 percent of Gaza's groundwater has become unfit for human consumption, causing irreversible damage to the aquifer system (Al-Hindi et al., 2021). This type of environmental coercion builds in vulnerability while keeping a certain level of plausible deniability and lowering the risk of legal responsibility. The choice between direct and indirect methods is based on strategic thinking about how the world will look at them, the goals of governance, and how long the coercive effects should last. Direct attacks have an immediate effect, but they also draw criticism and attention. Indirect degradation happens more slowly, but it has long-lasting effects on civilian life and recovery after a war.

2.5.3 Terrorism against the environment and civilians

A growing body of research defines the intentional targeting of environmental infrastructure as a manifestation of environmental terrorism, especially when these actions aim to instill fear in civilian populations rather than to achieve immediate military gain. Schillinger et al. contend that water facilities are particularly appealing targets due to the fear, uncertainty, and extensive damage their disruption causes, which is disproportionate to the resources needed to execute an attack (Schillinger et al., 2020).

Empirical evidence indicates that civilian harm is often a strategic goal rather than a mere byproduct. Spatial statistical analysis of infrastructure damage in Gaza shows clustering patterns that have less than a one percent chance of happening by chance. This suggests that civilian systems were deliberately targeted (Asi et al., 2024). In regions under its dominion, ISIS overtly denied access to water until the local populace acknowledged its authority, employing deprivation as a tool of governance and compliance (Daoudy et al., 2020).

Historical examples back up these results. The Iraqi government drained the Mesopotamian Marshes on purpose to get rid of an area that supported resistant groups. This shows how destroying the environment can help long-term counterinsurgency goals (Ariel I. Ahram et al., 2015). These cases collectively contest narratives that depict environmental degradation as collateral damage, instead highlighting deliberate strategies of civilian control via environmental manipulation.

2.5.4 Limitations, compromises, and unforeseen consequences

Even though it works well to force people to do things, targeting environmental infrastructure has a lot of limits. Numerous studies underscore the conflicts between weaponization and governance goals. For instance, ISIS's attempts at territorial administration necessitated the provision of fundamental services, resulting in internal contradictions between the utilization of water as a coercive instrument and the imperative to uphold administrative legitimacy (Von Lossow et al., 2016).

Being financially vulnerable is another limitation. The US-led coalition's systematic targeting of oil infrastructure cut off a lot of ISIS's income, making it harder for the group to keep control of territory and run its government (Bulmer et al., 2018). International condemnation and legal scrutiny further constrain the feasibility of prolonged environmental coercion, as humanitarian crises draw oversight that can undermine the legitimacy of coercive tactics (Yara M. Asi et al., 2024). The environmental effects may have long-term costs that are greater than the short-term benefits. Extensive ecological degradation can impede post-conflict recovery, perpetuate poverty, and destabilize areas beyond the immediate conflict zone, consequently undermining overarching strategic objectives (Von Lossow et al., 2020).

2.5.5 Implications for eco-weaponization and climate warfare

The deliberate targeting of environmental infrastructure shows that eco-weaponization works at the intersection of violence and governance, breaking down the usual lines between military operations and civilian administration. Water, energy, and agricultural systems serve as instruments of domination, allowing entities to manage populations, enforce compliance, and alter territorial conditions through the regulation of essential services. These dynamics are especially strong in the Middle East, where climate stress makes infrastructure more vulnerable. Rising temperatures, less rain, and more people put more pressure on weak systems, which makes environmental infrastructure more valuable as a tool of coercion. In these circumstances, infrastructure transforms from a mere casualty of war into a militarized domain. This analysis serves as the conceptual link to the subsequent section, which investigates the integration of these practices within extensive frameworks of hydro-hegemony and asymmetric power. The thesis transitions from the mechanisms of eco-weaponization to the geopolitical conditions that facilitate and perpetuate them by contextualizing infrastructure targeting within regional power dynamics.

2.6 Hydro-hegemony and asymmetric power

The notion of hydro-hegemony serves as a fundamental theoretical framework for examining the transformation of environmental systems—especially transboundary water resources—into tools of political leverage and strategic coercion. The framework, mainly created by Zeitoun and his team, shifts the focus of analysis from explanations of water conflict based on scarcity to the influence of power imbalances, weak institutions, and strategic interactions among riparian actors (Zeitoun et al., 2006). Hydro-hegemony provides a structural framework for analyzing environmental coercion beyond isolated conflict occurrences. Hydro-hegemony refers to the exercise of hegemony at the river basin level, accomplished when a dominant riparian successfully imposes its preferred allocation patterns, governance structures, or discursive frameworks on less powerful co-riparians (Zeitoun et al., 2006). In contrast to methods that focus on overt military force, the hydro-hegemony framework highlights a wider range of power, including material capacity, bargaining leverage, and ideational influence. This multifaceted comprehension is especially applicable for examining environmental coercion, wherein control is frequently exerted indirectly and institutionalized rather than imposed through overt violence (Menga et al., 2016).

2.6.1 Theoretical underpinnings of hydro-hegemony

The hydro-hegemony framework is based on Steven Lukes' three-dimensional view of power and Gramscian idea of hegemony. Lukes defines power as functioning across discernible decision-making, agenda-setting, and ideological dimensions. In hydropolitical analysis, these dimensions are redefined as material power, bargaining power, and ideational power, offering a systematic framework for understanding the production and maintenance of dominance in transboundary water governance (Zeitoun et al., 2006; Filippo Menga et al., 2016). Material power pertains to concrete abilities, encompassing economic assets, technological proficiency, military strength, and control over infrastructure. Bargaining power refers to the ability to use leverage, issue-linkage, and strategic positioning in diplomatic processes to change the outcome of negotiations. Ideational power includes the ability to set the standards, legal principles, and dominant stories about how water is managed. This affects how people see what is reasonable, legitimate, or unavoidable (Menga et al., 2016). Hegemonic actors sustain their dominance not merely through coercion, but by integrating their preferences into institutional structures and discursive frameworks that subordinate actors perceive as natural or inescapable (Zeitoun et al., 2006). This understanding is especially pertinent in environmental governance, where technical rationality, development discourse, and cooperation narratives frequently conceal fundamental power imbalances.

2.6.2 Forms and outcomes of hydro-hegemony

Later improvements to the hydro-hegemony framework make it possible to tell the difference between different types and results of hegemonic control. Hayat et al. categorize hydro-hegemonic configurations on a continuum from leadership-focused or "benign" structures to obstructive and oppressive forms of domination (S. Hayat et al., 2022). These distinctions are

analytically significant as they illustrate that hydro-hegemony is not intrinsically conflictual and may, under specific conditions, yield stability and cooperation. This typology simultaneously reinforces a principal argument articulated earlier in this chapter: cooperation does not exclude coercion. Even seemingly innocuous manifestations of hydro-hegemony can perpetuate enduring dependency, restrict the strategic autonomy of weaker riparians, and inhibit alternative governance pathways (S. Hayat et al., 2022). Stability attained under asymmetric conditions may consequently compromise equity and resilience, especially in areas marked by institutional fragility.

2.6.3 Structural basin asymmetries

Structural basin asymmetries, such as geographic location, economic strength, military strength, and technological strength, all play a role in determining hydro-hegemonic outcomes. Upstream location confers inherent advantages through physical control over water flows, yet geographic position alone does not automatically translate into hegemony (J. Allan et al., 2009). Power must be mobilized and sustained through complementary material, diplomatic, and ideational resources. Empirical studies show that downstream states can keep their dominant positions if they have better economic resources, more diplomatic power, or treaties that have been in place for a long time. Egypt's long-standing dominance in the Nile basin, despite being downstream, shows how material and ideational power can make up for a geographic disadvantage (J. Allan et al., 2009). Egypt has been able to stay in a dominant position even though upstream states are working on development projects because it controls narrative framing, legal interpretation, and international diplomacy. On the other hand, hydro-hegemony is especially strong in basins where geographic advantage goes hand in hand with material and technological superiority. The Tigris–Euphrates basin exemplifies this arrangement, with Turkey's upstream status bolstered by substantial dam infrastructure, economic strength, and political influence (Muralidharan et al., 2024). This combination of benefits makes it possible to keep control over flows and timing, which makes the differences between upstream and downstream states even bigger.

2.6.4 External actors and changing power relations

Newer research has added the roles of outside actors and time to the hydro-hegemony framework. Kehl illustrates that weaker riparians possess agency and can contest hegemonic structures by leveraging donor states, international organizations, and transnational advocacy networks (Kehl, 2011). These kinds of strategies add costs and risks to the reputation of the hegemonic power, which can limit its actions. The debate over Turkey's Ilisu Dam project shows how internationalized counter-hegemonic mobilization can change the way people think about costs and benefits, even if it doesn't completely change hegemonic control (Warner, 2008). These cases illustrate that hydro-hegemony functions within a wider international context and can be challenged through indirect methods rather than direct confrontation.

Temporal dynamics add to the complexity of hydro-hegemonic relations. Daoudy underscores that alterations in the political landscape, security imperatives, and regional coalitions can progressively undermine hegemonic standings over time (Daoudy et al., 2009). Power dynamics within river basins are not fixed; they are contingent and evolve in response to broader geopolitical changes.

2.6.5 Hydro-hegemony and eco-weaponization

Hydro-hegemony serves as an essential link between the analysis of structural power and the notion of eco-weaponization. Dominant actors can use both action and restraint to control transboundary water systems, turning environmental systems into tools of strategic leverage even when there is no open violence (Hayat et al., 2022). In the Middle East, hydro-hegemonic dynamics combine with climate stress, weak regional institutions, and long-running conflict to make environmental control even more powerful as a tool of coercion. Turkey's control of the Euphrates and Tigris rivers has been used many times as a political tool against Syria, for instance when Ankara linked the 1987 temporary water-sharing protocol—guaranteeing a minimum flow of 500 m^3/s to Syria—to Damascus's commitment to halt support for the Kurdistan Workers' Party (PKK), and later when it repeatedly reduced Euphrates releases to Kurdish-administered areas in northeast Syria to less than half that level in order to increase political and military pressure on local authorities (Kajjo & Sahinkaya, 2021, (*Turkey, Syria And Iraq : Conflict Over The Euphrates-Tigris*, 1960). This shows how decisions about water management can be used as weapons in larger security situations (Muralidharan et al., 2024). This thesis situates eco-weaponization within hydro-hegemonic frameworks, transcending episodic narratives of infrastructure targeting to elucidate the reasons for the continued viability of environmental manipulation as a strategic practice. Environmental systems transform into instruments of warfare not merely due to their vulnerability to assault, but because asymmetric power enables specific entities to regulate access, establish norms, and bear the political repercussions of coercion. This section thus establishes the structural basis for the empirical examination of water as a geopolitical instrument in the Tigris–Euphrates basin, as elaborated in Chapter 5. It also sets up the analytical shift to the last conceptual section, which looks at how environmental manipulation is a part of bigger plans for hybrid warfare and the targeting of social resilience.

2.7 Hybrid warfare and the targeting of societal resilience

Hybrid environmental warfare is characterized not by the magnitude of immediate devastation but by its temporal rationale. Many strategies of eco-weaponization work by causing long-term disruption, delayed failure, and gradual degradation of important systems, which is different from traditional military operations that focus on quick and visible effects. These practices don't cause immediate humanitarian collapse; instead, they slowly weaken society's ability to bounce back, govern, and adapt to new situations. This time-based aspect fits well with how things

work in other hybrid domains. Advanced Persistent Threats (APTs) in cyber warfare exemplify this approach, remaining embedded within monitoring or control systems for extended periods before producing effects that are operationally decisive or environmentally irreversible (Abraham et al., 2025). When used in environmental systems, this kind of persistence lets people take advantage of weak infrastructure without being seen or risking escalation that comes with open attacks.

In environmental situations, delayed impact is especially important. Polluting water sources, slowly draining aquifers, or permanently damaging irrigation networks may not cause immediate problems, but they slowly make public health, food security, and economic stability worse. Over time, these types of slow violence limit the options for policy responses that affected authorities can use and make it harder to recover after a conflict (Talhami et al., 2020). From a strategic standpoint, the capacity to cause harm without eliciting an immediate reaction amplifies coercive leverage while concealing accountability.

2.7.1 Coordination across domains

One of the most important parts of hybrid warfare is the planned coordination of different operational areas. Environmental manipulation seldom transpires in isolation; rather, it is coordinated with cyber, kinetic, economic, and informational strategies to yield synergistic effects. This coordination makes disruption worse and spreads responsibility across different areas, making it harder to find and respond to problems.

Economic coercion makes the environment even more vulnerable. Export restrictions, fuel supply disruptions, and financial sanctions converge with infrastructure targeting to limit access to energy and water resources, consequently heightening dependency and diminishing adaptive capacity (Popik et al., 2022). In environments stressed by climate change, these combined pressures may push systems that are already weak past their recovery limits, turning environmental stress into a strategic weapon instead of a background risk. These coordinated tactics are especially dangerous in the Middle East. A lot of reliance on centralized infrastructure, a lot of interdependence between energy and water systems, and not enough redundancy make it possible for the failure of one node—like a desalination plant, pumping station, or electricity grid—to affect many other areas. The outcome is increased civilian casualties and intensified political instability, even without prolonged military engagements.

2.7.2 Legal and normative challenges

Hybrid eco-weaponization presents significant difficulties to current legal and normative structures. International humanitarian law (IHL) protects civilian infrastructure and forbids attacks that don't discriminate, but its enforcement mechanisms aren't very good at dealing with indirect, deniable, or cumulative harm (Yara M. Asi et al., 2024). Manipulating the environment through blockades, denial of maintenance, cyber interference, or regulatory obstruction often occurs in legal gray areas, which makes it harder to hold people accountable and stop them from doing it again.

Numerous studies illustrate the intentional exploitation of such ambiguities. The UN Human Rights Council clearly called the destruction of Syria's Fijeh spring a war crime. Nonetheless, extensive patterns of infrastructural deterioration throughout the conflict remain predominantly unpunished owing to evidentiary limitations, challenges in attribution, and fragmented jurisdiction (Daoudy et al., 2020). This difference between what is legally allowed and what is actually enforced makes people want to use environmentally harmful methods that are below the legal limits. New rules and standards are trying to fix these problems. Proposals like the "Geneva Principles" for protecting water infrastructure want to make civilian protections stronger (Geneva Water Hub, 2023). Real-time monitoring and reporting systems are suggested as ways to make attribution and accountability better (Ruby Tabor et al., 2023). However, implementation is still uneven, especially in areas where power is not evenly distributed, institutions are weak, and sovereignty is disputed. Consequently, normative innovation has not significantly limited hybrid environmental coercion.

2.7.3 Strategic consequences for eco-weaponization

The integration of environmental manipulation into hybrid warfare strategies fundamentally alters the strategic calculus of conflict. Eco-weaponization is appealing not due to the assurance of immediate triumph, but because it functions beneath conventional thresholds of warfare, capitalizes on legal ambiguity, and generates enduring consequences that are challenging to reverse (Daoudy, 2020; Muralidharan et al., 2024). Environmental systems thus function as force multipliers, enabling actors to exert influence disproportionate to their conventional military capabilities (Buhaug et al., 2018).

In the Middle East, these factors come together with a high risk of climate change, a fast-growing population, and a reliance on water-intensive technologies like desalination and irrigation (World Bank, 2018). Climate change makes these problems worse by making environmental buffers weaker and making control of resources more politically important (Kelley et al., 2015). As a result, eco-weaponization in the region is not just a matter of taking advantage of opportunities; it is becoming more structural, built into larger plans for regional competition, deterrence, and security management (Daoudy, 2020; Ide, 2020). This last conceptual part finishes the analytical structure of Chapter 2 by putting eco-weaponization in the larger context of hybrid warfare and targeting societal resilience (Hoffmann, 2018; Brauch, 2018). This builds on earlier talks about targeting infrastructure, hydro-hegemony, and asymmetric power (Zeitoun & Warner, 2006). It shows that manipulating the environment is not an accident or a side issue in modern conflicts. Instead, it is a planned strategic move that takes advantage of environmental weaknesses to reach political, territorial, and strategic goals during times of climate stress (Mach, 2019; Muralidharan et al., 2024).

When put together, the frameworks created in this chapter—eco-weaponization, domination and cooperation, event-based typologies, historical genealogy, infrastructure coercion, hydro-hegemony, and hybrid warfare—give us a clear way to look at strategic climate warfare in the Middle East (Daoudy, 2020; Ide, 2020). Instead of seeing environmental damage as a side effect of war, they let us look at how climate change, power imbalance, and weak institutions work together to turn environmental systems into tools of coercion (Brauch, 2018). Chapter 2's conceptual framework shows that eco-weaponization is a strategically embedded practice that works at the crossroads of environmental vulnerability, asymmetric power, and hybrid warfare (Hoffmann, 2018). The chapter transcends mere descriptive narratives of

environmental damage by synthesizing viewpoints on domination and cooperation, infrastructure targeting, hydro-hegemony, and societal resilience, thereby offering a structured analytical framework for the examination of strategic climate warfare in the Middle East (Zeitoun & Warner, 2006; Daoudy, 2020).

Nevertheless, mere conceptual clarity fails to adequately represent the practical unfolding of these dynamics. The mechanisms identified—environmental manipulation, infrastructural coercion, and strategic exploitation of climate stress—are highly context-dependent and vary across political, institutional, and geographic settings (Buhaug et al., 2018; Kelley et al., 2015). Consequently, their analysis necessitates a methodological framework adept at delineating causal processes, discerning strategic intent, and contextualizing empirical observations within overarching power structures. So, Chapter 3 explains the methodology used in this thesis. It elucidates the research design, case selection strategy, and data sources employed to operationalize the theoretical concepts presented in Chapter 2. Special attention is paid to the reasons for choosing cases, the use of qualitative process tracing, and the combination of documentary, spatial, and secondary. This methodological framework aims to maintain analytical precision while addressing the evidentiary and attribution complexities associated with the examination of environmental coercion and hybrid conflict (Hoffmann, 2018; Muralidharan et al., 2024).

Chapter 3 — Methodology and case selection

This chapter outlines the methodological framework utilized to investigate eco-weaponization as a manifestation of strategic climate warfare in the Middle East, building upon the theoretical framework established in Chapter 2. It elucidates the research design and the rationale behind empirical selection, delineates the establishment of theoretical foundations via a systematic literature review, articulates the comparative case study strategy and data sources, and highlights the primary methodological limitations. The chapter also puts the regional focus in the context of the whole thesis. It says that Chapter 4 gives a detailed argument for why the Middle East is a good place for eco-weaponization.

3.1 Research design: A qualitative, descriptive, theory-building comparative case Study

This thesis adopts a qualitative, descriptive, theory-building comparative case study design. The selection of this design reflects both the nature of the research question and the current conceptual underdevelopment of eco-weaponization as a consolidated analytical category. Eco-weaponization concerns strategic practices, institutional choices, and contested interpretations of environmental manipulation in conflict environments. These dynamics are typically embedded in context, mediated by political narratives, and shaped by infrastructure and governance constraints; they are therefore not easily captured through isolated numerical indicators without sacrificing explanatory nuance. For this reason, a qualitative approach is appropriate because it is suited to understanding complex processes and context-dependent meanings rather than estimating effect sizes or testing statistically generalizable hypotheses (Creswell, 2009). The research is also descriptive in a substantive methodological sense. It seeks to identify and classify recurring patterns of environmental manipulation in conflict settings before evaluating their strategic significance. In qualitative analysis, description is not simply a preliminary step but a foundation for rigorous explanation, because the credibility of later claims depends on how clearly the relevant phenomena and their sequence are specified (Collier, 2011). In this thesis, descriptive work therefore serves to clarify what counts as environmental manipulation in practice, how it appears empirically, and how it may be distinguished from collateral damage or infrastructural deterioration associated with general wartime conditions. Finally, the thesis is oriented toward theory-building rather than hypothesis-testing. Where an analytical concept is still emerging, qualitative research is particularly useful for sharpening definitions, identifying mechanisms, and clarifying the conditions under which a phenomenon is likely to occur. In this sense, theory-building approaches aim to refine constructs and specify scope conditions through careful engagement with empirically informative cases (Eisenhardt, 1989). The objective here is not to begin from a fully settled model and test it deductively, but to consolidate and refine an explanatory framework for eco-weaponization that can travel across cases and enable more systematic research in future work (Eisenhardt, 1989).

3.2 Case study logic and comparative design

The thesis utilizes a comparative case study methodology due to its fundamental research inquiries being explanatory and context-dependent, concentrating on the mechanisms through which environmental systems serve as tools of coercion and the circumstances under which climate-related vulnerability enhances strategic leverage. Case study research is especially suited for investigating "how" and "why" questions related to contemporary phenomena situated in real-world contexts, particularly when the researcher possesses limited control over events and when context serves not merely as a background factor but as an integral component of the causal narrative (Yin, 2014). This study does not seek statistical generalization. Rather, it adheres to the principles of analytical generalization, utilizing empirical evidence to enhance and broaden theoretical assertions (Yin, 2014). The objective is not to quantify the prevalence of eco-weaponization in all conflicts, but to elucidate its mechanisms and to discern the conditions that facilitate or impede it. The comparative aspect utilizes the principles of structured, targeted comparison. This method facilitates systematic comparison by employing a uniform set of theoretically grounded questions across cases, while maintaining depth within each case. It is especially helpful for developing theories in complicated, multi-causal areas because it combines careful within-case analysis with cross-case comparison. This cuts down on mistakes that can happen when you only compare cases (George & Bennett, 2005). This thesis analyzes each case using a uniform framework that addresses climate stress and environmental vulnerability, the centralization and strategic significance of water infrastructure, actor constellations and governance capacity, the discernible manifestations of environmental manipulation, and the strategic aims and conflict results linked to these practices. The design is best described as a most-different systems design with a common baseline. The cases exhibit structural scarcity, dependence on centralized infrastructure, and climate-induced stress, while differing in actor types, governance capacity, and conflict dynamics. This combination enables the thesis to investigate the recurrence of analogous patterns of eco-weaponization across diverse contexts and, equally crucially, to delineate the specific configurations upon which these patterns depend. Employing multiple cases in this manner corresponds with replication-focused reasoning in qualitative theory development, wherein an emerging mechanism acquires legitimacy by manifesting across diverse contexts rather than being a singular characteristic of a single case (Eisenhardt, 1989).

3.3 Systematic literature review: Scope, screening, and search strategy

Prior to the selection of cases and the execution of empirical analysis, a comprehensive literature review was conducted to formulate a solid theoretical framework for the concept of eco-weaponization. A structured review is especially essential in an interdisciplinary and evolving field as it fosters transparency in study selection, mitigates arbitrary citation practices, and assists in identifying areas of convergence in the literature as well as persistent gaps. Methodological guidance on research design and literature reviews underscores the significance of systematic engagement with extant scholarship, incorporating computerized databases and defined screening protocols (Creswell, 2009). There were two parts to the review. The first stage was a broad screening to find important debates in the areas of climate-conflict research, environmental security, hydro-politics, and infrastructure targeting. Search strings included

terms like "water weaponization," "weaponization of water," "water as a weapon," "hydro-hegemony," "environmental security," "climate security," "environmental warfare," "infrastructure targeting," "dam sabotage," "Middle East water conflict," "Tigris Euphrates dam politics," and "Yemen water infrastructure conflict." Boolean operators were used to narrow down the results. The second stage consisted of targeted refinement, emphasizing peer-reviewed scholarship that directly addressed the strategic manipulation of environmental systems and the governance or security ramifications of water infrastructure. We used major multidisciplinary and social science databases that are often used in international relations and related fields, such as Research Gate, Scopus, JSTOR, ScienceDirect, Taylor & Francis Online, and Google Scholar, to search. In addition to academic publications, we also looked at policy and NGO repositories that had systematic documentation that was useful for conflict situations. Peer-reviewed work was the main source of ideas and theory building, while grey literature was mostly seen as evidence that needed to be carefully checked. Inclusion criteria were established to preserve conceptual coherence. Included works focused on environmental or water manipulation in violent, coercive, or conflictual contexts; analyzed the Middle East or similar water-scarce areas. Materials in English were given priority. Studies that addressed environmental degradation devoid of political or strategic aspects were omitted. This screening strategy made sure that the ideas were consistent and gave the theoretical basis for putting eco-weaponization into action.

3.4 Case selection: Criteria and rationale

Case selection followed a purposive logic aimed at theoretical leverage rather than statistical Case selection adhered to a purposive rationale focused on theoretical advantage rather than statistical representativeness. The selected cases were chosen due to their empirical richness and theoretical relevance for analyzing eco-weaponization in water-scarce, climate-stressed conflict settings, aligning with the principles of theoretical sampling in qualitative theory-building research (Eisenhardt, 1989). Moreover, the comparative design necessitates cases that possess a shared baseline while differing along analytically significant dimensions to reveal persistent patterns and contextual conditions (George & Bennett, 2005). Three criteria were used to choose. First, the cases are based on situations where water systems are strategically important, such as transboundary basins or centralized water infrastructures that support civilian populations and affect economic activity. Second, they include big dams and water networks that serve two purposes: they support civilian life and can be used to control or govern people. Third, the chosen settings include reliable evidence of environmental manipulation during conflict, such as cutting off water supplies, taking over infrastructure, flooding strategically, or systematically depriving people of basic needs. Consequently, the thesis concentrates on four empirical domains: Syria–Iraq, Yemen, Gaza, and the Turkey–Syria–Iraq basin politics. These arenas differ in terms of actor constellation, governance capacity, temporal profile, and conflict dynamics, yet they exhibit commonalities in structural scarcity and infrastructural dependence. This combination is meant to help compare cases without assuming that eco-weaponization looks the same in every situation. The selection of the Middle East as the regional focal point is regarded as an analytically significant decision rather than a mere presumption. This chapter talks about the selection logic at a procedural level. Chapter 4, on the other hand, looks at why the Middle East is a good place for eco-weaponization in more detail, focusing on climate stress, hydropolitical asymmetries, and conflict fragmentation.

3.5 Data collection and sources

Due to the difficulties in directly observing conflict processes and the political sensitivity of infrastructure-related data, the study employs triangulation from various categories of sources. The empirical material relies chiefly on peer-reviewed scholarship for conceptual advancement and for corroborated case-based results. Reports from UN agencies and well-established NGOs that show damage to infrastructure, effects on people, and patterns of civilian vulnerability add to this. Hydrological and climate data are used to put claims about water scarcity, drought, or changes in reservoirs into context whenever they are available. Media investigations and conflict monitoring databases are used carefully and seen as extra information, with the most important thing being to confirm information from different sources. This strategy of using evidence from more than one source is in line with case study advice that says using more than one source of evidence is important for validity (Yin, 2014).

3.6 Methodological limitations

There are a number of limits on what the thesis can say. First, attribution is still a big problem. In conflict zones, it can be hard to tell the difference between intentional manipulation and accidental damage, carelessness, or weak infrastructure. You can guess what someone's strategic intent is based on their actions and the situation, but direct evidence is inconsistent and stories are often disputed. Second, the availability of data is limited by ongoing conflicts, a lack of monitoring resources, and the politicization of reporting. It may be hard to get complete or consistent hydrological information, and it may not always be easy to check it on the ground. Third, using secondary sources can lead to bias and uneven coverage across cases, even if triangulation is used to lessen these risks. Fourth, language barriers make it hard to get to documents in the local language, which could change both the evidence and the way events are framed. Even with a common foundation of scarcity and centralized infrastructure, the political and environmental diversity within the region makes direct comparison challenging. The objective is not to assert uniformity, but to discern recurring patterns while delineating the contexts in which mechanisms are dependent on specific configurations. In this regard, the study is focused on analytical generalization rather than statistical generalization, utilizing empirical findings to enhance a theoretical framework and elucidate scope conditions (Yin, 2014; George & Bennett, 2005). The integration of systematic literature review, structured cross-case comparison, purposive case selection, and multi-source triangulation establishes a coherent framework for analyzing eco-weaponization as a mechanism-based phenomenon in climate-stressed conflict environments (Creswell, 2009; Eisenhardt, 1989; Yin, 2014; George & Bennett, 2005).

Chapter 4: The Structural causes of eco-weaponization in the Middle East

This chapter investigates the reasons the Middle East is a particularly conducive setting for eco-weaponization. In previous chapters, eco-weaponization was defined as the intentional alteration of environmental systems—particularly water, land, and energy infrastructures—to compel populations, limit opponents, or modify negotiation stances. This chapter, however, transitions from mechanisms to facilitating conditions. The analysis shifts focus from tactical deployment to the political economies, governance frameworks, hydrological patterns, and socio-demographic influences that convert environmental systems into enduring tools of strategic advantage. The main point of this chapter is that eco-weaponization in the Middle East should not be seen as an unusual result of only war or climate change. Instead, it arises as an anticipated outcome of a series of interconnected structural conditions: (i) authoritarian and rentier governance frameworks, (ii) infrastructural centralization entrenched in patronage networks, (iii) prolonged hydrological deterioration coupled with transboundary disparities, and (iv) interdependencies among water, food, and energy systems. These conditions do not automatically lead to conflict. Instead, they make environmental systems more strategically valuable while also making it cheaper to change them politically, legally, and administratively. This is especially true in situations where there is little oversight, little accountability, and governance that excludes certain groups (Morrissette & Borer, 2004; Ide et al., 2020).

4.1 Centralization of resources and authoritarian rule

To use eco-weapons, there must be leverage. In the Middle East, this kind of power is often created by putting control of water and energy systems in the hands of executive institutions and closely related technocratic agencies. In many parts of the region, governance structures are very centralized, which makes it easy to quickly move resources around, choose which constituencies to prioritize, and limit access with little transparency or accountability. In these circumstances, environmental systems are not solely governed as public goods but are incorporated into more extensive frameworks of political control (Richter et al., 2019; Lambert et al., 2014).

Centralization enables the technical capability and political latitude necessary to exploit environmental resources. Decisions about how to allocate, maintain, and invest are not subject to societal bargaining or legislative oversight. This means that executive actors can use their control over infrastructure to gain political power. This structural arrangement is especially favorable for eco-weaponization, as it facilitates the manipulation of life-sustaining systems with minimal institutional resistance.

4.1.1 Rentier political economy and independence from society

The rentier state model offers a fundamental rationale for the vulnerability of environmental infrastructures to instrumentalization. Rentier states obtain a significant portion of their fiscal capacity from external rents, particularly hydrocarbons, instead of domestic taxation. This results in regimes that are structurally more autonomous from society and less reliant on negotiation or citizen consent (Richter et al., 2019).

The rentier dynamics in the Middle East exhibit cyclical patterns. Periods of high oil income after nationalizations and price booms, especially in the 1970s and between 2007 and 2014, were linked to new efforts to build the state and expand infrastructure. On the other hand, long periods of low prices, like those from 1986 to 2004, were bad for the economy and the government (Richter et al., 2019). This cyclicality is important for analysis because it affects both the ability and the reasons for states to centralize and control important infrastructures. Saudi Arabia shows how political power can come from oil and gas money, technical know-how, and infrastructure. The ruling family's power was based on the abundance of oil, which also allowed the central government to slowly gain control over land, resources, and people (Jones et al., 2010). This expansion was made possible by global networks of scientific, engineering, and institutional expertise that helped the state think about and put into action ways to control the environment. The Arabian American Oil Company (Aramco) helped the government make money and improve its administrative and technical skills, which connected political power to environmental control (Jones et al., 2010). The implication for eco-weaponization is clear: the ability to give, take away, or set conditions on access to important services depends on having control over expertise and infrastructure.

4.1.2 Water scarcity as a politically constructed resource

If there is a lot of hydrocarbons, it makes people more politically independent. If there isn't enough water, it makes people dependent. In dry areas, governments make themselves seem like the only ones who can provide important resources for survival by centralizing their provision and allocation (Lambert et al., 2014). In this context, scarcity is not only a biophysical condition but is often generated and perpetuated through policy decisions.
In Syria, the lack of water has often been seen as a problem that comes from outside the country. However, empirical analysis indicates that it was substantially produced by the Baʿth party’s persistent advocacy of water-intensive agriculture, motivated by objectives of food self-sufficiency and bolstered by rural political constituencies, including the Peasants Union (Barnes et al., 2009). Scarcity serves both as a consequence of political decisions and as a rationale for ongoing state intervention and regulation.

Barnes also says that spatial and administrative practices create scarcity. State planning, mapping, and classification systems "order" water scarcity in ways that allow for certain governance strategies. This shows that the politics of water work on more than just interstate

hydropolitics (Barnes et al., 2009). This understanding is fundamental to eco-weaponization: when scarcity is constructed through narrative and administrative means, disputes over attribution and claims of responsibility become more susceptible to politicization and strategic exploitation.

4.1.3 Infrastructure as state-making technology

Centralized infrastructures are not politically neutral technical artifacts. They work as tools for making states by putting power into everyday life and acting as a bridge between people and government institutions. The desalination systems used by the Gulf monarchies are very clear examples. While desalination is frequently depicted as a technological solution to aridity, Lambert et al. demonstrate that the extensive production, subsidization, and distribution of desalinated water constituted a component of a more comprehensive political strategy aimed at redistributing oil revenues, ensuring tribal allegiance, and legitimizing the expansion of state authority (Lambert et al., 2014).

The ability of Gulf cities to deliver dependable water supplies in the face of severe aridity should be regarded as a political consequence influenced by leadership decisions, financial resources, and institutional frameworks, rather than merely a result of technological accessibility (Lambert et al., 2014). This viewpoint elucidates why privatization does not inherently reduce political influence. In the region, privatizing water often means changing how control works instead of getting rid of it. Authority transitions from direct provision to regulation, pricing, and contract governance, while the strategic significance of infrastructure persists (Lambert et al., 2014).

4.1.4 Patronage networks and distributional control

Resource control is often integrated into patronage systems that convert the distribution of resources into political allegiance. Water and land have historically been used in Yemen to help manage tribal relationships. In places where formal legal systems weren't strong, patronage networks and strategic division were the main ways to run things (Unruh et al., 2016). The Saleh regime gave large amounts of land and water to government-appointed shaykhs, who then divided it up among their followers, creating layers of dependency and long-lasting chains of obligation (Unruh et al., 2016).

Similar dynamics are observable in other contexts. In Jordan, patterns of water use favor certain groups and keep the current political system in place. Foreign aid keeps the regime stable while allowing what Bonn et al. call "two opposed but coexisting resource realities" to continue: reformist discourse and entrenched usage patterns (Bonn et al., 2013). These configurations highlight that environmental allocation serves as a tool for political management rather than a neutral reaction to scarcity.

When you put rentier autonomy, scarcity-based dependency, infrastructure provision, and patronage distribution together, you get a redundant system of control. When one

mechanism weakens, like when the economy shrinks, others can make up for it (Richter et al., 2019; Lambert et al., 2014; Unruh et al., 2016). This redundancy elucidates the persistence of environmental systems as politically relevant and vulnerable to weaponization, even amidst institutional strain.

4.2 Socio-environmental stress and institutional fragility

The permissive structural conditions described above have political consequences when environmental stress intersects with governance deficiencies and institutional frailty. The literature uniformly regards climate impacts as contingent pressures rather than independent causes of instability. Environmental stress manifests in political outcomes via policy failures, inconsistent responses, and infrastructural vulnerability, rather than through deterministic mechanisms (Ide et al., 2018; Ide et al., 2020). This interactional framing is crucial for comprehending how socio-environmental stress transforms into a strategically exploitable resource.

4.2.1 Drought as a principal stressor, but not a sufficient cause

Drought is the most common and serious climate stressor in most of the Middle East and North Africa (Ash et al., 2019; Ide et al., 2018). The Syrian drought from 2006 to 2009/2010 is often described in the literature as being very large and lasting a long time. It has been characterized as a "once in 500-year meteorological drought" and recognized as the driest three-year interval in the instrumental record, with effects primarily observed in the northeastern governorates of Al-Hasakah, Deir ez-Zor, and Raqqa (Ash et al., 2019; Ide et al., 2018). Ide et al. report a Standardized Precipitation–Evapotranspiration Index (SPEI) greater than 1.5, which means that the drought conditions are much worse than usual (Ide et al., 2020). The humanitarian consequences were extensive: over 1.3 million people were affected, and approximately 803,000 reportedly lost almost all livelihood assets as crop yields collapsed and livestock mortality increased sharply (Ide et al., 2018; Ash et al., 2019).

Kelley et al. introduce two analytically pertinent dimensions to this narrative. Attribution studies show that human-caused climate change made severe and long-lasting droughts more likely, making an event of this size two to three times more likely than if it were just natural variability. Second, the intense drought from 2007 to 2010 happened during a longer period of moderate to severe dry conditions from 1998 to 2009, which was the worst time of stress, not an isolated event (Kelley et al., 2015). These findings are significant as they emphasize the influence of climate trends and the significance of multi-year stress accumulation in determining vulnerability. Simultaneously, the literature uniformly warns against mono-causal interpretations. Drought does not incite conflict without political and institutional mechanisms that convert livelihood stress into grievance development, mobilization, and contestation (Ide et al., 2018; Ide et al., 2020). In Syria, the consequences of drought were

markedly exacerbated by policy failures, including the elimination of subsidies, insufficient distribution of aid, ineffective regulation of groundwater extraction, and ongoing political repression (Ide et al., 2018; Ash et al., 2019). The current analysis is fundamentally anchored in an interactional perspective: environmental stress transforms into a strategic asset when institutions inadequately absorb shocks, responses are inequitably allocated, and accountability can be politically designated or disputed.

4.2.2 Migration, grievance of formation, and spatial concentration of vulnerability

Climate-induced internal migration is one of the most well-documented ways that environmental stress can lead to social and political instability. The long-lasting drought in Syria caused a lot of people to move from the countryside to cities like Aleppo, Damascus, Dara'a, Hama, and Homs. Displacement estimates frequently indicate that around 1.5 million individuals migrated from rural regions to urban peripheries during this timeframe (Ide et al., 2018; Kelley et al., 2015). Kelley et al. underscore the subsequent socio-economic repercussions of this migration: nutrition-related diseases surged, school enrollment allegedly plummeted by as much as 80 percent in impacted communities, and urban fringe regions witnessed swift population growth without a parallel enhancement of services or infrastructure (Kelley et al., 2015). Ash et al. present subnational evidence that correlates environmental stress with demographic shifts and protest dynamics, eschewing deterministic causation. Utilizing nighttime lights data, they demonstrate that drought conditions correlated with diminishing light intensity in impacted rural areas, aligning with population out-migration trends. Between 2005 and 2010, there was a strong link between more nighttime lights and a higher risk of protests in Sunni Arab areas. This suggests that the arrival of displaced people made the problems in already marginalized urban areas worse (Ash et al., 2019). This method is useful for analysis because it links environmental stress to visible changes in space and political action through intermediate mechanisms instead of direct cause and effect. Similar dynamics exist beyond Syria. In Jordan, which is already one of the countries with the least water, climate stress combined with population pressure and the arrival of hundreds of thousands of Syrian refugees (Kempf et al., 2024; Krueger et al., 2025). Amman, which has seen waves of refugees since the 1960s, is called a "migration hotspot" because more people moving there increased demand in a system with strict rationing and limited infrastructure (Krueger et al., 2025; Britchenko et al., 2025). These cases demonstrate how climate-induced migration alters urban vulnerability and intensifies strain on institutional and infrastructural systems.

4.2.3 Infrastructure weakness, corruption, and feedback loops

Institutional fragility is most evident in instances of infrastructure failure. In the Middle East, many people live in cities and rely on centralized water and energy systems. This means that problems with these systems can have significant effects right away (Hameed et al., 2019). Jordan's water rationing system is a good example of this. Many homes only get piped water for 12 to 24 hours a week, so they have to rely on private tanker services, which are very expensive (Britchenko et al., 2025; Krueger et al., 2025). Krueger et al. delineate a self-perpetuating cycle wherein intermittent supply exacerbates pipe deterioration and leakage, heightening both scarcity and contamination risks, while financial limitations and governance deficiencies impede repairs—entrenching the system in a scarcity–degradation feedback loop (Krueger et al., 2025). In places where there is conflict or political division, weak infrastructure is linked to clientelism and corruption. Reports say that the ability to manage water in Syria's coastal basins fell to about 30% of what it was before the war. During the conflict, the amount of water available per person dropped from about 760 m^3 per year in dry periods before the war to less than 500 m^3 per year, which is below the level of absolute water scarcity (Faour et al., 2014). Mason et al. contend that the deteriorated condition of the water treatment network in Iraq's Basra governorate illustrates a post-2003 political system characterized by entrenched clientelism and politically endorsed corruption. Procurement practices, maintenance failures, and fragmented authority weakened the resilience of infrastructure. At the same time, changes in the climate and weather made the problems worse (Mason et al., 2022). In these situations, eco-weaponization works by taking advantage of weakness instead of strength. Control over the few parts of infrastructure that still work—and the ability to block access, slow down repairs, or change maintenance—becomes politically important. Environmental systems become strategic levers not due to their abundance, but because their failure disproportionately impacts already vulnerable populations.

Lastly, the region's social and environmental stress isn't just caused by drought. Regional analyses record exposure to various hazards, such as flash floods in Saudi Arabia from 2009 to 2011, persistent dust storms in parts of the Middle East from 2007 to 2013, and the devastating 2023 Medicane flood in Libya, which resulted in approximately 15,000 fatalities in Derna (Hameed et al., 2019; Nasef, 2025). The Derna disaster in particular showed how weak institutions can quickly turn into large-scale humanitarian disasters when extreme events happen. This is because of old infrastructure and uncontrolled urban growth. This kind of exposure to multiple hazards makes it easier to assign blame, argue over who is responsible, and use environmental failure for strategic purposes.

4.3 Hydrological decline and systemic vulnerability

Section 4.2 looked at how short-term shocks make politics less stable. This section looks at longer-term hydrological trends that weaken baseline resilience. Long-term drops in rainfall, river flows, and groundwater levels make people more vulnerable in a structural way, not just a temporary way, which makes it harder to adapt over time (Chenoweth et al., 2011; Kelley et al., 2015; Rajsekhar et al., 2017).

4.3.1 Precipitation decline and drought intensification

Climate models consistently forecast a reduction in precipitation in the eastern Mediterranean and the Middle East, estimating a decline of approximately 10 percent by mid-century and the end of the century, compared to late twentieth-century baselines (Chenoweth et al., 2011). The trends we see back up these predictions. Since 1931, winter rainfall in Syria has dropped by about 13 percent. This is a statistically significant drop that will have a direct effect on agriculture that relies on rain and surface water recharge (Kelley et al., 2015). Forecasts for Jordan are even more alarming: by 2070–2100, rainfall is expected to drop by about 30% from the 1981–2010 baseline (Rajsekhar et al., 2017). Rajsekhar et al. point out a very important change in how droughts work, in addition to the average decline. Their study shows that meteorological, agricultural, and hydrological drought types are becoming more common at the same time. By the end of the century, the number of times that more than one type of drought happens at the same time is expected to rise from about 8 in 30 years to about 25 in 30 years. This change is linked to an estimated 80 percent rise in the number of times warm and dry events happen at the same time (Rajsekhar et al., 2017). This kind of convergence is important because it shortens recovery times and makes it harder for people and organizations to handle stress. These changes are strategically important not only because they make things more scarce, but also because they make politically important stress episodes happen more often. As droughts happen more often and in more ways, people who depend on water for their jobs become less resilient, and environmental stress becomes a constant state instead of a sudden shock.

4.3.2 Declining river flows and transboundary asymmetry

One of the most well-known signs of regional hydrological stress is rivers that are drying up. The Yarmouk River is a good example of size and effect. Despite bilateral agreements between riparian states (Avisse et al., 2020), annual flows fell by more than 85 percent, from about 450–500 hm^3 per year to about 60 hm^3 per year by 2010. Jordan is especially vulnerable downstream. Watershed simulations show that climate change alone could cut the Yarmouk inflows to Jordan by 51–75 percent compared to the average over the past few years. If Syrian irrigated agriculture were to return to pre-conflict levels, the consequent decrease in transboundary flow would be approximately double that caused solely by climate change (Rajsekhar et al., 2017). By the end of the century, the King Talal and Al-Wehda dams are expected to receive 31% and 65% less water each year, respectively (Rajsekhar et al., 2017).

Similar trends can be seen in the Euphrates–Tigris basin, where river flows have shrunk over the past 30 years because of the combined effects of building big dams and expanding irrigation (Glass et al., 2017). Modeling indicates that the Euphrates segment of the basin is nearing critical thresholds, where irrigation demand would require the transfer of saline water from other segments, indicating compounded quantity–quality stress (Rougé et al., 2018).

These hydrological trends coincide with significant transboundary power imbalances. The Southeastern Anatolia Project (GAP) in Turkey is a good example of how building large-scale infrastructure gives upstream leverage. Even though there is proof that better water management would be good for everyone in the basin, competition between states and within states has repeatedly stopped talks. Unilateral hydro-development persists amidst restricted transparency and inadequate data sharing (Glass et al., 2017). Glass et al. also talk about legal disputes that haven't been settled yet, such as whether the river system should be treated as one unit or as separate parts, whether the rivers are international or just cross-border, and whether principles of fair use or no harm should apply. This legal uncertainty serves as strategic protection for maximal upstream extraction (Glass et al., 2017). Amery et al. underscore that downstream states encounter exacerbated insecurity due to the interplay of upstream dam construction, climate change, and internal governance limitations (Amery et al., 2020).

A key nuance is that armed conflict can alter hydrological patterns in counterintuitive and unexpected ways. Reports say that streamflow to Jordan went up during the Syrian conflict because less irrigated farming and less dam retention upstream. Migration and conflict dynamics resulted in an estimated 50 percent reduction in Syrian irrigated agriculture and rainfall retention in dams, illustrating the feedback loops between political instability and water availability. These dynamics complicate linear scarcity narratives and reinforce the thesis's emphasis on politicized attribution and contested responsibility.

4.3.3 Groundwater depletion and irreversible degradation

Groundwater depletion is a type of vulnerability that moves more slowly but is still very important. In Syria, excessive groundwater extraction resulted in the desiccation of the Khabur River, with satellite data indicating substantial decreases in groundwater levels. Cumulative depletion exacerbates salinization and deteriorates water quality at depth in manners that may be effectively irreversible within human timescales (Kelley et al., 2015; Moore et al., 2011). Yemen is a very extreme example of this process. Groundwater extraction happens about four times faster than the natural recharge rate, which means that the capital city of Sana'a could run out of groundwater completely (Weiss et al., 2015). Similar broad regional studies show that the Middle East and North Africa are also experiencing widespread overexploitation, less recharge, higher salinity, and seawater intrusion (Fragaszy et al., 2020). Groundwater depletion results in more than just immediate scarcity. It slowly eats away at the resource base, making it less flexible in the future and making it more reliant on systems that can still be controlled. From a strategic point of view, this permanent decline makes infrastructures and aquifers that are still working more valuable politically and through force. This makes the structural conditions that make eco-weaponization possible even stronger.

4.4 Intra-state versus inter-state conflict dynamics

The strategic importance of hydrological decline is contingent upon the manner in which scarcity is navigated through political contexts and divisions. The literature examined in this chapter consistently indicates that water-related stress is more prone to result in intra-state rather than inter-state conflict dynamics (Ide et al., 2020; Daoudy et al., 2021). This observation does not negate the existence of interstate hydropolitics or the significance of transboundary negotiations. Instead, it emphasizes that the most destabilizing political consequences of environmental stress typically arise within states, where distributional conflicts, governance failures, and coercive control over services directly impact civilian populations. Empirical research delineates various mechanisms by which water insecurity transforms into a politically actionable issue at the domestic level. Linke et al. demonstrate that violent incidents in Syria from 2011 to 2019, instigated by both government forces and armed opposition groups, were considerably more prevalent during the agricultural growing season. This temporal pattern indicates that violence was utilized strategically to seize agricultural resources—such as arable land and harvests—or to obstruct opponents' access to food supplies through intentional destruction. During the conflict, arid conditions correlated with a rise in government-initiated assaults, suggesting that environmental stress influenced both opportunity frameworks and strategic assessments (Linke et al., 2021).

In addition to armed violence, nonviolent water-related conflict represents a significant yet relatively under-researched aspect of intra-state instability. Ide et al. assert that protests and demonstrations concerning water access, pricing, or service provision hold substantial political significance, especially during periods of drought. Their examination of 34 cases in the Middle East and North Africa from 1996 to 2009 illustrates that drought conditions, in conjunction with pre-existing social divisions and either autocratic governance or disruptions in water supply, significantly heightened the probability of nonviolent conflict initiation (Ide et al., 2020). These findings highlight how environmental stress interacts with regime type and institutional capacity to produce domestic contention.

The protests in Basra are another example of how water insecurity can intensify intra-state conflict and spill over into tensions between states. Mobilization in the governorate was closely associated with deficiencies in water governance, declining water quality, and the deterioration of treatment infrastructure, all of which were compounded by upstream water diversions and cross-border management practices. In this context, local grievances over water service failure articulated themselves not only as domestic contestation against the Iraqi state but also as political accusations directed at neighboring states—particularly Iran—over their role in reducing river flows and contaminating shared waterways (“Iraq: Water Crisis in Basra,” 2020). Mason et al. contend that these dynamics exemplify extensive trends of institutional fragmentation and clientelism, rendering service failure politically discernible and actionable (Mason et al., 2022). Interstate water conflicts, on the other hand, have historically been easier to solve through technological changes, trade agreements, and diplomatic talks (Galgano et al., 2016). Nonetheless, various authors warn that this trend may become increasingly unreliable as climate change modifies hydrological distributions and the prevalence of fragile or failing states rises, potentially undermining diplomatic capacity and compliance mechanisms (Galgano et al., 2016). The structural implication for eco-weaponization aligns with the overarching thesis of this chapter: environmental manipulation is most effectively executed in contexts of fragmented

domestic governance and where coercive power can be applied to civilian infrastructures with minimal institutional constraints.

4.5 The water–food–energy nexus and cascading vulnerabilities

Systemic interdependence makes eco-weaponization even worse. In the Middle East, water, food, and energy systems are closely linked, so problems in one area can have a ripple effect on others. Nexus analysis offers a framework for comprehending why relatively limited interventions—such as water supply reductions, irrigation disruptions, or energy infrastructure sabotage—can yield political and social ramifications that significantly surpass their immediate context (Al-Muqdadi et al., 2024). Iraq shows how having different levels of government makes nexus more vulnerable. Al-Muqdadi et al. record the participation of around 228 state and non-state actors in the decision-making processes regarding water, food, and energy, resulting in an institutional framework marked by conflicting responsibilities, poor coordination, and insufficient accountability. This fragmentation makes it harder to manage the nexus as a whole and makes it easier for people to manipulate it, especially when politically connected investors have a say in how resources are used and infrastructure is built (Al-Muqdadi et al., 2024; Molle et al., 2018). The drought in Syria is another example of how nexus dynamics can make environmental stress worse. The collapse of agriculture and the deaths of livestock happened at the same time as the displacement of about 1.5 million people. This put even more stress on urban water and energy systems. Government policies put more emphasis on farming and food self-sufficiency than on long-term sustainability. This made the depletion of groundwater worse and made water scarcity worse. These policy decisions exacerbated interdependencies within the nexus and fostered greater political instability (Kelley et al., 2015).

Maladaptive responses to scarcity also make nexus vulnerability worse. Short-term coping strategies, particularly heightened dependence on groundwater due to surface-water deficits, can entrench systems in unsustainable pathways. Britchenko et al. delineate maladaptation cycles that jeopardize the establishment of a "permanent resource crisis and irreversible scarcity," whereas Krueger et al. elucidate feedback loops in Amman where infrastructure deterioration exacerbates rationing and reliance on private supply (Britchenko et al., 2025; Krueger et al., 2025). Molle et al. incorporate a political economy perspective into these dynamics: aquifer depletion increases abstraction costs and hastens social differentiation as smaller farmers are effectively "pumped out," while the economic significance of groundwater engenders substantial political opposition to regulating extraction (Molle et al., 2018).

Energy systems exacerbate these interdependencies. Somer et al. contend that investments in renewable energy within certain areas of the region are frequently driven more by the aim of augmenting oil and gas export revenues through diminished domestic consumption than by decarbonization goals, indicating that energy transitions may perpetuate rentier dynamics (Somer et al., 2017). This continuity is significant for eco-weaponization, as both legacy infrastructures—like oil facilities—and new systems—like renewable grids and desalination plants—are possible targets. Diversification strategies are still very dependent on

stable water and energy supplies, which makes them easy to disrupt when the climate is stressed or there is political conflict (Wehrey, 2023). Chapter 4's analysis has demonstrated the structural feasibility of eco-weaponization in the Middle East, not merely as a consequence of scarcity, but through the intersection of concentrated governance, infrastructural centralization, protracted hydrological decline, intra-state conflict, and closely interconnected water–food–energy systems. These circumstances enhance the strategic significance of environmental control while diminishing the institutional and political barriers to manipulation. Chapter 5 now shifts from structural permissiveness to empirical manifestation. It investigates how actors convert these facilitating conditions into tangible coercive practices by analyzing discerned patterns of water as a geopolitical tool in the Tigris–Euphrates basin, associating enduring infrastructural supremacy with instances of intentional deprivation and service regulation amid climate-induced stress (Zeitoun & Warner, 2006; Hayat et al., 2022; Daoudy, 2020; Paula Duarte Lopes et al., 2025).

Chapter 5 — Water as geopolitical leverage: empirical patterns of eco-weaponization

Climate-induced scarcity increasingly transforms water systems from environmental constraints into instruments of political leverage (Daoudy, 2020; Duarte Lopes et al., 2025). Building on the structural drivers identified in Chapter 4, this chapter examines empirical manifestations of eco-weaponization in the Tigris–Euphrates basin and beyond.
The analysis proceeds across three scales:

1. **Transboundary infrastructural control** (Turkey's dam system in the Tigris–Euphrates basin);
2. **Conflict-based coercive disruption of civilian water infrastructure** (northeast Syria);
3. **Non-state and urban siege dynamics**, including ISIS hydro-insurgency, Syrian and Yemeni urban warfare, and water deprivation in Gaza.

Taken together, these cases demonstrate that eco-weaponization operates along a continuum. It encompasses long-term infrastructural dominance, strategic manipulation during active conflict, and siege-based deprivation targeting civilian dependency systems. Climate stress amplifies each of these modalities by increasing scarcity and reducing resilience buffers (Zeitoun & Warner, 2006; Hayat et al., 2022).

5.1 Structural eco-dominance in the Tigris–Euphrates basin

5.1.1 Turkey's GAP and long-term water control

The Southeastern Anatolia Project (Güneydoğu Anadolu Projesi, GAP) is one of the best recent examples of how controlling infrastructure upstream can give you long-term geopolitical power. GAP started out as an idea in the 1930s under Mustafa Kemal Atatürk and became a formal multi-sector development program in the 1970s and 1980s. It includes 22 dams and 19 hydroelectric power plants on the Euphrates and Tigris rivers (Warner, 2008; Kibaroğlu & Scheumann, 2011). The project covers about 75,193 square kilometers, which is about 9.7% of Turkey's total land area. It also includes about 20% of Turkey's total irrigable land (Meijer, 2018). Its most consequential infrastructural nodes include the Atatürk Dam on the Euphrates (completed in 1990) and the Ilisu Dam on the Tigris (operational since May 2020), which together provide Turkey with near-complete physical capacity to regulate downstream flows into Syria and Iraq (Muralidharan et al., 2024; Al-Quraishi et al., 2021).

This arrangement exemplifies what hydro-hegemony scholarship defines as "resource capture": the consolidation of authority over transboundary water systems via unilateral infrastructural development that gradually alters dependency dynamics (Zeitoun & Warner, 2006; Warner, 2008). Turkey's upstream position, along with its better economic resources, technological capacity, and political power, creates a hydro-hegemonic system in which geographic advantage matches material and ideational power (Hayat et al., 2022; Daoudy, 2009). Warner (2008) shows that Turkey's power works on many levels at once. For example,

it uses infrastructure-based flow regulation to gain material power, issue-linkage (like the 1987 dual protocol linking Euphrates releases to Syria's stopping of PKK support) to gain bargaining power, and framing GAP as legitimate development instead of coercive manipulation to gain ideational power (Kibaroğlu & Scheumann, 2011; Muralidharan et al., 2024).

5.1.1.1 Documented decreases in downstream flows since the 1970s

The hydrological impacts of GAP have been documented across various temporal and spatial dimensions. Baseline indicators indicate that the Euphrates River flow at the Turkey–Syria border exceeded 900 m³/s prior to significant dam construction, while the flow at the Iraq–Syria border reached approximately 920 m³/s before 1975 (Al-Quraishi et al., 2021; Kibaroğlu & Scheumann, 2011). The early GAP infrastructure was finished in the 1970s, and the Keban and Karakaya reservoirs were built. This caused major drops in downstream flows, including a drop to 197 m³/s at the Iraq–Syria border in 1975 (Al-Quraishi et al., 2021). It took a full month to stop the flow of the Euphrates River in order to fill the Atatürk Dam in 1990. This caused strong protests from Syria and Iraq, even though Turkey promised that the releases would make up for the cutoff (Kibaroğlu & Scheumann, 2011). The flow effects on the Tigris have gotten worse since the Ilisu Dam went into operation in May 2020. According to Iraqi officials, the amount of water they get from the Tigris has dropped from more than 20 BCM per year to less than 5 BCM. The amount they get from the Euphrates has also dropped from about 42 BCM per year to about 8 BCM. This means that Iraq's water supply from the two rivers has dropped by about 80 percent since 1975 (Watchers News, 2025; Arab Center DC, 2023). The Ilisu Dam alone is expected to cut the flow of the Tigris River to Iraq by up to 56%. This will have downstream effects, such as more saltwater coming in from the Persian Gulf and the collapse of farming in areas that used to be productive (Global Voices, 2022).

5.1.1.2 Reports since 2017 of releases below the 1987 protocol's 500 m³/s threshold

The 1987 Protocol on Economic Cooperation between Turkey and Syria set up a temporary deal in which Turkey agreed to release "a yearly average of more than 500 m³/s" at the Turkish–Syrian border, with plans to make up for any shortfalls in the following months (Kibaroğlu & Scheumann, 2011; Turkish Ministry of Foreign Affairs, 1996). The protocol has served as the primary legal reference for Euphrates allocation, despite being explicitly interim and lacking Iraqi participation, in the absence of a basin-wide agreement (Warner, 2008; Daoudy, 2009). Turkish government sources say that releases have always been above the 500 m³/s level and give examples of times when they were said to be above 800–1,600 m³/s during times of heavy rain (Turkish Ministry of Foreign Affairs, 1996; Kibaroğlu & Scheumann, 2011). However, several independent sources say that shortfalls have been happening since 2017, and that releases below the threshold have been happening continuously since January 2021 (Hawarnews, 2023; Fanack Water, 2025). Authorities in Syria and Iraq, international organizations, and academic studies all agree that recent discharges have averaged around 200 m³/s during drought years. This is less than half of the agreed minimum, which has led to the drawdown of Syrian dam reserves and had cascading effects on agriculture and humanitarian efforts downstream (Hawarnews, 2023; North Press Agency, 2021; Fanack Water, 2025). The difference between upstream claims and downstream reports is due to disagreements over measurements and the protocol's lack of clarity on seasonal variability, compensation mechanics, and enforcement (Kibaroğlu & Scheumann, 2011; Glass, 2017). Syria and Iraq do

not have independent monitoring at Turkish release points, which creates an uneven flow of information that gives upstream leverage more power (Warner, 2008; Daoudy, 2009). The lack of a Joint Technical Committee with the power to inspect, which Turkey suggested in the 1960s but never put into action, makes this lack of clarity even worse (Kibaroğlu & Scheumann, 2011).

5.1.1.3 Period when Syria and Iraq recorded flows below 200 m³/s

During severe droughts, reported downstream flows have dropped below the already low 200 m³/s average. Syrian monitoring stations recorded flows nearing zero during the summer months from 2021 to 2023, significantly affecting the Tabqa, Tishreen, and Baath dams along the Euphrates (Hawarnews, 2023; Fanack Water, 2025). Fanack Water (2025) says that the Tabqa reservoir (Lake Assad), which is the main source of drinking water for more than five million people, has dropped by six meters since 2020. This makes it more likely that hydropower generation and irrigation will stop working. In Iraq, reservoir storage levels were said to have hit an 80-year low in 2025, with total reserves dropping to 10 BCM from a seasonal average of 18 BCM. This led to unprecedented agricultural restrictions and the prioritization of drinking water over irrigation (Watchers News, 2025). These extreme hydrological fluctuations are widely understood to result from the combined effects of climate change and upstream infrastructural management policies. Climate predictions say that by the middle of the century, the Tigris will flow 29% less and the Euphrates will flow 73% less. This is because there will be less rain in the headwaters of Turkey and Syria, more water will evaporate, and the way snow melts will change (Olcay & Veret, 2022; Dezfuli et al., 2022). When layered on top of current extraction and impoundment practices, these trajectories suggest that conditions below 200 m³/s may become structurally persistent rather than episodic, which could have direct effects on the viability of agriculture downstream and the supply of cities (Cascades, 2021; Al-Ansari, 2019).

5.1.1.4 Accusations by NGOs and local authorities that reductions constitute deliberate water pressure

The political interpretation of reductions has gradually transitioned from technical dissent and compliance discourse to overt accusations of intentional water weaponization. The Syrian government says that Turkey's policies are "expansionist and colonial," and that limiting water use is "a weapon to achieve political, military, and economic gains" (CETIM, 2020). Iraqi officials also say that Turkey is using the Ilisu Dam operations to force people to do things. Former Prime Minister Haidar al-Abadi said that managing the dam was linked to bargaining over Kurdish autonomy and regional security (Arab Center DC, 2023). More and more, international groups and regional NGOs are using a rights-based approach. A joint statement from 110 Syrian civil society groups said that cutting off water flow is a violation of the right to water and that "parties like the Turkish government intentionally deny civilians in northeast Syria their right to access safe and sufficient water" (Syrians for Truth and Justice, 2023). Human Rights Watch has recorded Turkey's "failure to ensure adequate water supplies to Kurdish-held areas" as detrimental to humanitarian response capacity, while the Centre Europe-Tiers Monde (CETIM) has labeled flow manipulation as war crimes against the Syrian populace (Fanack Water, 2025; CETIM, 2020). Scholarly discourse contextualizes these allegations within the frameworks of hydro-hegemony and eco-weaponization. Warner (2008)

posits that Turkey’s hydraulic strategy functions at domestic, basin, and regional tiers, associating water leverage with counterinsurgency aims against Kurdish populations. Daoudy (2020) interprets water manipulation in Syria as consistent with a “domination and legitimacy” modality, through which flow control undermines adversary governance capacity and consolidates authority. Van Steen (2021) asserts that the scarcity of freshwater alone does not elucidate Turkey's decisions to reduce water flows, highlighting historical grievances, the interconnection of issues with non-water security concerns, and strategic considerations regarding Kurdish autonomy as more immediate factors. Attribution is still up for debate because long periods of severe drought put pressure on upstream states to put national supply first, which makes them less likely to follow treaty obligations (Van Steen, 2021; Cascades, 2021). Turkey is also dealing with climate stress. In January 2022, the Ilisu reservoir reportedly fell below the 500-meter operational threshold because there was less rain (Arab Center DC, 2023). This dual scarcity—domestic and transboundary—fuels "competitive scarcity dynamics," in which allocation is viewed as zero-sum rather than being optimized through collaborative management (Glass, 2017; Warner, 2008). At the same time, the timing of flow reductions—below-threshold releases reported from 2017 onward, getting worse during the Syrian conflict—raises questions about strategic timing that go beyond climate change. The most significant reported declines from 2021 to 2023 align with Turkey's military actions against Kurdish forces and increased tensions with the Autonomous Administration of North and East Syria (AANES), indicating a connection between water policy and overarching security goals (Fanack Water, 2025; Hevdesti, 2023). This alignment bolsters interpretations of flow manipulation as coercive leverage, with climate stress serving concurrently as an amplifier and justificatory framework (Daoudy, 2020; Van Steen, 2021). From a hydro-hegemony standpoint, Turkey's actions demonstrate the coexistence of cooperation and coercion in asymmetric contexts (Hayat et al., 2022; Zeitoun & Warner, 2006). The 1987 Protocol can be interpreted as "coerced cooperation," wherein consent signifies limited alternatives rather than fair distribution (Hayat et al., 2022; Daoudy, 2009). Selective compliance—upholding minimums in less vulnerable situations while decreasing releases during periods of peak downstream reliance—demonstrates how cooperative frameworks can be exploited within hegemonic strategies (Warner, 2008; Cascão & Zeitoun, 2010). Turkey's hydrological dominance constitutes institutionalized eco-dominance, characterized by a convergence of infrastructural control, legal ambiguity, and climate amplification, resulting in sustained leverage over downstream states and populations (Warner, 2008; Muralidharan et al., 2024). This empirical pattern substantiates the theoretical assertion articulated in Chapter 2, which posits that eco-weaponization functions not solely through isolated violent acts but also via governance frameworks and infrastructural realities that normalize asymmetry and integrate coercive potential within routine provisioning systems (Paula Duarte Lopes et al., 2025; Hayat et al., 2022).

5.1.2 The Alouk/Allouk water station (northeast Syria from 2019 to 2025)

5.1.2.1 Seizure during operation peace spring and subsequent control

GAP shows long-term eco-dominance of infrastructure, while the Alouk water station shows how civilians' water infrastructure can be used as a weapon during active conflict. Alouk is the main source of drinking water for about 460,000 people in the al-Hasakah governorate, which includes the city of al-Hasakah, Tal Tamer, and major displacement camps (OCHA, 2023; UNICEF, 2020). It is located near Ras al-Ain (Serê Kaniyê). The station is an important piece of civilian infrastructure that can draw 175,000 m³ of water per day from 30 wells. If it is damaged, it has immediate and far-reaching effects on humanitarian efforts (Syrians for Truth and Justice, 2020). On October 9, 2019, the Turkish military took over the station, just hours after "Operation Peace Spring" began against Kurdish forces in northeast Syria (Syrians for Truth and Justice, 2021; Amnesty International, 2022). Artillery fire hit the station's facilities and cut power lines that supplied the pumps, making the station unusable (Syrians for Truth and Justice, 2021). After that, Turkish forces and Turkish-backed Syrian National Army (SNA) groups took control, making it so that people who are openly hostile to the Kurdish-led AANES government in areas downstream have to go through them to get water (Hevdesti, 2023; PAX, 2020). As an occupying power under international humanitarian law, Turkey has to make sure that people can get to basic services like water (CETIM, 2020; Syrians for Truth and Justice, 2020). Article 55 of the Fourth Geneva Convention says that occupying powers must make sure that food and medical supplies are available and that they bring in goods when local resources aren't enough (Syrians for Truth and Justice, 2020). The Hague Regulations also say that the occupying powers must keep the peace and safety of the people. In this context, the systematic disruption of water services in occupied territory presents specific IHL concerns that extend beyond general hostilities regulation (CETIM, 2020; Amnesty International, 2022).

5.1.2.2 Recuring shutdowns—Over 40 interruptions recorded in eight months in 2023

Since October 2019, Alouk has been shut down many times. Humanitarian groups have called these shutdowns "systematic disruption" that is consistent with the use of weapons. OCHA recorded 24 total disruptions from November 2019 to June 2023, lasting anywhere from a few days to several weeks (OCHA, 2023). The North Press Agency said that there were more than 40 interruptions in just eight months in 2023, which shows that the frequency of disruptions is going up (North Press Agency, 2023). The timing of the shutdowns suggests that they are in line with the larger conflict. Major interruptions happened in February 2020 (ten-day shutdown), March 2020 (multiple shutdowns after Russian mediation failed), April 2020, July 2020, August 2020 (eighth shutdown), March 2021, and again with a complete halt starting on June 23, 2023—the 28th recorded disruption since takeover (Syrians for Truth and Justice, 2021; North Press Agency, 2025; OCHA, 2023). The increased disruption happened at the same time as increased military tension between Turkish-backed forces and the AANES-aligned SDF, as well as important moments in the Russian-mediated bargaining for electricity for water (Syrians for Truth and Justice, 2021). Shutdown mechanisms have included stopping pumping, keeping maintenance teams from getting to the pumps, sabotaging the electrical supply that feeds the pumps, and shelling the pipelines that connect Alouk to treatment facilities

downstream (OCHA, 2023; Syrians for Truth and Justice, 2021). OCHA reported that only five of the 21 boreholes and one of the four horizontal pumps were still working before the power went out completely on June 26, 2023. This suggests that the damage was gradual rather than one-time (OCHA, 2023).

5.1.2.3 Reported effects—deprivation affecting about 460,000 civilians in Al-Hasakah governorate

Shutdowns have humanitarian effects that go beyond just making it harder to get water. They also have effects on public health, food security, and economic stability. About 460,000 people depend directly on Alouk, but when you add in people who depend on it indirectly through irrigation, camp supply systems, and water-trucking networks, the total number of people affected is said to be as high as one million (OCHA, 2023; PAX, 2020; UNICEF, 2020). Al-Hasakah city needs about 150,000 m³ of water every day, but during shutdowns, it has only gotten 1,000 m³, which is less than one percent of what it needs every day (Syria Direct, 2023). When the water supply is cut off, people have had to use unsafe options like shallow wells and untreated sources, or they have had to buy expensive trucked water. Reported prices were 1,000 to 1,200 Syrian pounds per 200-litre barrel, which is about 30 percent more than in 2020. This put a lot of stress on poor families (PAX, 2022). Using contaminated sources at the same time as outbreaks of waterborne diseases, such as cholera cases reported in northeast Syria in 2022–2023, made the risk of spreading the disease even worse (The Century Foundation, 2023). UNICEF repeatedly warned that not having enough water during the COVID-19 pandemic made it harder for hundreds of thousands of people to follow basic safety rules like washing their hands (UNICEF, 2020; Syrians for Truth and Justice, 2020). Internally displaced people are especially vulnerable. Alouk-sourced water delivered through humanitarian logistics networks is what camps like al-Hol and al-Arishah rely on (OCHA, 2023; Amnesty International, 2022). Al-Hol, which is home to about 100,000 people, reportedly had complete cutoffs during shutdowns, which humanitarian groups called "catastrophic" (OCHA, 2023). Targeting or exploiting such concentrated vulnerability corresponds with assertions in infrastructure-targeting literature concerning the strategic utilization of civilian dependency to enhance coercive effect (Daoudy, 2020; Schillinger et al., 2020). Connected infrastructure shows downstream cascade effects. The Al-Himmeh reservoir and treatment station, which serves al-Hasakah city and is fed by Alouk, holds a capacity of 30,000 m³ but reportedly fell to around 7,500 m³ by June 2023—below minimum operating levels—making it effectively non-functional (OCHA, 2023). There is no longer any backup capacity. Since December 2020, none of the 50 boreholes at Al-Himmeh have worked because of brackish water contamination, making Alouk flows the only source of water (OCHA, 2023). Booster stations like Al-Aziziya and Tal Tamer also stopped working during long outages, showing how single-node control can cause the whole system to fail (OCHA, 2023).

5.1.2.4 Shelling damage to pipelines and electricity – water bargaining

The Russian military has repeatedly linked water provisioning at Alouk to clear negotiations between electricity and water. In December 2019, talks led to an agreement in which AANES would send electricity from the Tishreen Dam to Turkish-controlled areas around Ras al-Ain. In exchange, Turkish troops would let Alouk run (Syrians for Truth and Justice, 2021). According to reports, early agreements called for 7–10 MW for Alouk operation and the Mabrouka station to serve areas controlled by Turkey (North Press Agency, 2021; Syrians for Truth and Justice, 2021). This deal quickly turned into forced reciprocity. When AANES cut off electricity, which happened a lot after Turkish shelling or incursions, Turkish-backed forces reportedly shut down Alouk pumping. When the water stopped, AANES cut off electricity to Mabrouka (Syrians for Truth and Justice, 2021). In March 2020, Russian officials criticized Turkey for blocking the relaunch of the station and not following through on mediated agreements, even though Russia was still helping to provide electricity from Tishreen (Syrians for Truth and Justice, 2021).

Reported Turkish demands grew over time, going from 7–10 MW to 23–25 MW by March 2020. This would mean taking electricity away from other AANES-controlled areas, which could hurt civilian services in Raqqa, Deir ez-Zor, and Manbij (North Press Agency, 2021; Syrians for Truth and Justice, 2021). The Ras al-Ain local council, which is part of the Turkish-backed opposition, said that the shutdowns were a response to AANES's electricity cuts. But the basic imbalance still exists: AANES controls electricity generation, while Turkish forces and SNA factions control a main drinking-water source for almost half a million people. This gives them unequal coercive power, since cutting off water causes immediate harm to people (Hevdesti, 2023; CETIM, 2020). These problems have gotten worse because of physical damage. Shelling damaged pipelines that connected Alouk to downstream reservoirs, and Turkish forces reportedly wouldn't let repair teams in (OCHA, 2023; Syrians for Truth and Justice, 2021). An electrical fire at the Derbasiyeh substation in April 2023 made things even worse, and reports said that it was hard to get the technical help needed to fix things (OCHA, 2023). This pattern—damage followed by access denial—aligns with "indirect degradation" strategies identified in infrastructure targeting literature: rendering systems inoperable through maintenance obstruction rather than overt destruction, thereby lowering visibility and complicating legal accountability (Daoudy, 2020; Asi et al., 2024).

5.1.2.5 Alouk as state-controlled coercive water deprivation in active conflict

Humanitarian groups and legal advocates have called the Alouk case a very clear example of using water as a weapon in an active conflict zone (Human Rights Watch, 2020; Syrians for Truth and Justice, 2020; CETIM, 2020). This classification is supported by several criteria: direct state military control over civilian water infrastructure, repeated disruptions exceeding 40 incidents within a limited timeframe, explicit utilization of water access as a bargaining tool, anticipated humanitarian harm impacting civilians and displaced populations, and synchronization with cycles of conflict escalation and negotiation (Daoudy, 2020; Grech-Madin et al., 2025).

According to Daoudy's (2020) four-modality typology, Alouk shows multiple modalities at the same time: domination and legitimacy by undermining AANES's ability to govern; military tool by working with cease-fire and negotiation dynamics; military target by shelling and

sabotage; and coerced cooperation by making deals for electricity for water through Russian mediation. Grech-Madin et al. (2025) delineate a multi-dimensional framework categorizing the practice as deprivation (characterized by denial rather than contamination), strategic objective (involving political pressure and the subversion of governance), and mass-harm intensity impacting civilian welfare across various sectors. The case is different from opportunistic collateral damage because the interruptions happen often and last for a long time (Grech-Madin et al., 2025; Von Lossow et al., 2016).

Intentionality — frequently debated in eco-weaponization research — can be examined through various evidentiary strands (Reininghaus et al., 2019; Paula Duarte Lopes et al., 2025). First, the timing of shutdowns is linked to political and military events, not just technical problems. This is especially true during cease-fire talks and mediation cycles (Syrians for Truth and Justice, 2021). Second, Turkish-backed authorities made it clear that they were conditional by saying that providing water was dependent on providing electricity and publicly justifying shutdowns as a response to AANES cuts (Syrians for Truth and Justice, 2021). Third, the number and length of shutdowns are more than what is needed for maintenance, especially since repairs have been reported to be blocked (OCHA, 2023). Fourth, the humanitarian effects of stopping pumping were clear and directly related to the decision to stop pumping. These effects included 460,000 people losing access to drinking water, including people who were displaced during a pandemic (UNICEF, 2020; Syrians for Truth and Justice, 2020).

It has been clear that legal and advocacy framing has taken place. The title of Human Rights Watch's March 2020 report was "Turkey/Syria: Weaponizing Water in Global Pandemic." It directly called the shutdowns coercive acts (Human Rights Watch, 2020). A group of Syrian civil society organizations said that interruptions were against international humanitarian law and were war crimes (Syrians for Truth and Justice, 2020). CETIM also said that Turkey's actions were war crimes because they used water shortages as a weapon for political, military, and economic gain (CETIM, 2020). UN bodies have also documented violations of water rights in occupied areas, but enforcement is still not very strong (Syrians for Truth and Justice, 2023). The case also shows how the roles of the state and non-state actors overlap. Turkey still has effective control as the occupying power, but it has given operational control to Turkish-backed SNA factions. This creates "agency layering," which makes it harder to assign blame (Warner, 2008; Daoudy, 2020). Turkey says it doesn't have direct control, but it gives power to local councils or the "Syrian Government." At the same time, Turkey provides security and effective oversight (CETIM, 2020). This lack of clarity makes it easier for coercion to continue without much accountability. On a larger scale, Alouk fits with a multi-level hydro-hegemonic strategy. At the basin level, GAP infrastructure supports structural dominance over flows that cross borders (Warner, 2008). At the regional level, water leverage intersects with counterinsurgency objectives concerning Kurdish autonomy, connecting water control to security aims, such as the containment of Kurdish governance structures (Warner, 2008; Muralidharan et al., 2024). At the local level, Alouk is a way to put pressure on AANES, show civilians the costs of their actions, and weaken the enemy's legitimacy by controlling infrastructure that is necessary for survival (Hevdesti, 2023; CETIM, 2020).

Climate change makes Alouk shutdowns even more coercive by making baseline scarcity worse and making it harder to cope (Cascades, 2021; Fanack Water, 2025). Northeast Syria has been in a drought for several years, and the Euphrates River's flow has been reported

to be around 200 m^3/s, which is well below the 1987 level. Reports say that agricultural production has dropped sharply (Hawarnews, 2023; PAX, 2022). Even short shutdowns have big effects on people in need in these situations, since there aren't many other options and people can't afford to buy things (Syria Direct, 2023; OCHA, 2023). This interaction closely mirrors the "force multiplier" concept articulated in Chapter 2: climate change enhances the efficacy and political ramifications of coercive practices rather than generating them ex nihilo (Paula Duarte Lopes et al., 2025; Ide et al., 2018).

Alouk thus provides empirical validation of fundamental theoretical assertions: eco-weaponization functions through both structural configurations (GAP) and severe coercive measures (systematic shutdowns), while cooperation mechanisms (electricity-for-water agreements) can persist alongside ongoing civilian suffering within asymmetric power dynamics (Hayat et al., 2022; Zeitoun & Warner, 2006). Most significantly, it demonstrates water deprivation as a form of governance warfare—focused not merely on gaining a tactical advantage but on delegitimizing the opponent, indicating state ineptitude, and altering civilian loyalties through the manipulation of essential services (Daoudy, 2020; Schillinger et al., 2020).

The patterns described above show that eco-weaponization works along a continuum from long-term structural dominance to acute coercive deprivation, with both types of weaponization becoming more severe because of climate-induced scarcity. GAP infrastructure creates long-lasting conditions for leverage, such as almost complete physical control over flows across borders, ongoing legal uncertainty about allocation rights, and an uneven ability to monitor that puts downstream actors at a disadvantage (Warner, 2008; Zeitoun & Warner, 2006). In contrast, Alouk creates this situation by repeatedly taking away people's basic needs, which leads to an immediate humanitarian crisis and shows the political costs of resisting Turkey's regional goals (Daoudy, 2020; Hevdesti, 2023). The two modalities support each other. Structural dominance creates dependency and vulnerability that make acute deprivation more effective (Hayat et al., 2022; Paula Duarte Lopes et al., 2025). On the other hand, repeated threats to disrupt the water supply make the threat of structural control more believable, which gives the other side more power in negotiations even when nominal releases or station operations start up again (Schillinger et al., 2020; Warner, 2008). In this context, hydro-hegemonic relations are characterized not by a dichotomy of coercion and cooperation, but by a strategic repertoire wherein both can function either sequentially or concurrently within an asymmetrical framework (Zeitoun & Warner, 2006; Daoudy, 2009). Climate change alters this strategic landscape by exacerbating scarcity, amplifying hydrological volatility, and diminishing the resilience buffers upon which downstream populations depend to mitigate disruption (Cascades, 2021; Dezfuli et al., 2022). Forecasts suggest ongoing reductions in basin flows, an increase in drought occurrences, and heightened competition for the dwindling water resources (Al-Ansari, 2019; Cascades, 2021). In these circumstances, eco-weaponization may transition from a sporadic practice to a more ingrained aspect of regional geopolitics (Paula Duarte Lopes et al., 2025; Muralidharan et al., 2024). Legal and institutional protections have not been enough to stop these actions or keep civilians safe. The 1987 Protocol does not have any ways to make sure that everyone follows it; there is still no agreement across the whole basin; and Turkey's dual role as both a riparian power and an occupying authority makes it hard to hold people accountable (Kibaroğlu & Scheumann, 2011; Warner, 2008). Humanitarian organizations have comprehensively documented impacts but have insufficient capacity to

enforce operational change, leading to a disparity between normative condemnation and material constraint (Human Rights Watch, 2020; OCHA, 2023).

This evidentiary record reinforces a tension highlighted in Chapter 2: environmental systems become coercive instruments precisely where power asymmetries are acute and institutional protections are weak (Paula Duarte Lopes et al., 2025; Hayat et al., 2022). In the Tigris–Euphrates basin, upstream infrastructural dominance, downstream fragility, climate-amplified scarcity, and limited regional enforcement converge to create conditions highly permissive for eco-weaponization—conditions likely to emerge in an expanding number of transboundary basins as climate stress intensifies (Cascades, 2021; Zeitoun & Warner, 2006).

5.2 Non-state eco-weaponization: ISIS and hydro-insurgency

The systematic manipulation of water resources by non-state armed groups represents a significant advancement in modern conflict practices, especially in regions characterized by pre-existing hydrological stress and highly centralized infrastructure. The Islamic State of Iraq and Syria (ISIS) exemplifies hydro-insurgency: a form of asymmetric warfare wherein the control of dams, barrages, treatment facilities, and distribution systems is amalgamated with territorial expansion, coercive governance, and the generation of strategic outcomes that exceed traditional military capabilities. From 2014 to 2017, ISIS consistently regarded water not merely as a supplementary resource but as a strategic instrument, utilizing deprivation, inundation, sabotage, and service manipulation to alter civilian dependency and adversary mobility. This section examines ISIS's water coercion as both an insurgent strategy and a practice facilitated by infrastructural chokepoints and climate-induced scarcity, in alignment with the conceptual frameworks established in Chapter 2 and the structural vulnerabilities delineated in Chapter 4 (Daoudy, 2020; von Lossow, 2016).

5.2.1 The Fallujah barrage (Iraq, 2014)

ISIS took over the Fallujah Barrage on the Euphrates in April 2014. This strategically located structure is about 100 kilometers west of Baghdad (von Lossow, 2016). The episode exemplifies the dual-use rationale of hydro-coercion, wherein a singular water infrastructure can be weaponized via both retention (flooding and upstream disruption) and release (downstream inundation and operational obstruction), facilitating swift transitions between denial and excess as tactical conditions change (Grech-Madin, 2025).

After the takeover, ISIS reportedly closed the floodgates of the barrage and kept water behind the structure. The immediate effect was to flood a large area upstream—about 500 square kilometers—affecting agricultural areas, residential areas, and Iraqi government military positions. At the same time, it cut off or slowed down the flow of supplies to Shiite-majority areas that relied on regulated flows (von Lossow, 2016; Gleick, 2019). The flooding forced about 40,000 people to leave their homes and destroyed thousands of them. This created a humanitarian emergency that made government-held areas even more unstable and made it harder for the state to respond (ORSAM, 2025). In this setup, coercion didn't depend on ongoing fighting; instead, controlling the infrastructure caused people to move and made life harder, while also turning the terrain into a barrier to military movement.

Two days later, ISIS changed their operational stance by opening the floodgates and letting the water flow downstream. This was said to be to stop Iraqi forces from moving toward Fallujah and to mess up areas that rely on controlled discharge (von Lossow, 2016). This sequencing—first retaining, then releasing—captures the tactical dimension of water weaponization identified in the literature: environmental systems are mobilised within the immediate battlespace to alter mobility, constrain advances, and generate defensive depth without requiring decisive battlefield victory (Schillinger et al., 2020). Simultaneously, the episode fulfilled a distinct psychological role. By showing that they could take control of life-sustaining infrastructure and cause terrible damage to many communities, ISIS made people lose faith in the Iraqi government's ability to keep people safe and protect important services (Schillinger et al., 2020).

The Fallujah case is best understood as insurgent hydro-coercion: the strategic use of water systems to flood target areas while also cutting off access to other populations by denying them supplies. In dry areas, especially when climate change makes things worse, this two-part system uses water's irreplaceability and the lack of quick replacement options to get the most out of coercive leverage (Daoudy, 2020; King, 2023).

5.2.2 Seizures of dams in Mosul, Haditha, Ramadi, and other places

ISIS's attempt to take and keep important hydraulic infrastructure went far beyond Fallujah. It took control of the Mosul Dam, Iraq's largest hydraulic structure, from August 7 to August 18, 2014. This showed how important large-scale hydrotechnical assets can be in asymmetric conflict situations (Gleick, 2019). The dam is about 50 kilometers northwest of Mosul and provides water to about six million Iraqis. It also makes a lot of the electricity in the area (ORSAM, 2025). The capture had immediate effects on many levels, such as the US launching heavy airstrikes to help Iraqi and Kurdish Peshmerga forces retake the facility (BBC News, 2014). The strategic importance of the Mosul Dam came from two things that were connected. First, the dam's long history of geological weakness—structural instability caused by karst foundation conditions that needed constant grouting—made the possibility of failure seem real, whether it was caused by neglect, sabotage, or a deliberate breach (Al-Ansari et al., 2021). Officials in the United States said that if the dam broke, a wave that was said to be 20 meters high could hit Mosul and cause a lot of damage downstream, all the way to Baghdad, which is about 400 kilometers away (BBC News, 2014). King (2023) sees this as a strategic weapon: infrastructure that can cause a lot of deaths outside of the immediate combat zone. Second, even without catastrophic failure, control of the dam enabled leverage over electricity generation and downstream availability, allowing ISIS to manipulate flows and services to reward aligned communities and punish adversary constituencies (von Lossow, 2016).

Reports say that ISIS did a lot of damage to infrastructure, equipment, and facilities while they were there for 11 days. This made it harder to fix things up later (Al-Ansari et al., 2021). Even a short occupation had lasting effects, showing how short-term seizure can lead to long-term damage. More generally, Mosul is part of a larger pattern in which ISIS saw large dams along the Tigris and Euphrates as important parts of its territorial strategy, similar to how it systematically took over oil assets as a source of income and a way to govern (von Lossow, 2016). Similar forces were at work when ISIS tried to take the Haditha Dam on the Euphrates. This facility gives Baghdad drinking and irrigation water and about 30% of Iraq's electricity.

Because of this, it was a strategic goal and a contested site in 2014 and 2015 (ORSAM, 2025). Iraqi forces, with help from U.S. airpower, stopped ISIS from taking control of the dam many times because they knew that losing it would be a serious threat to the country's water and energy security (von Lossow, 2016). ISIS took control of the Ramadi Dam upstream of Baghdad in May 2015. They reportedly stopped operations and sent water into Lake Habbaniya, bringing Anbar province to what was called the "brink of an environmental catastrophe" (Securing Europe, 2015). Reportedly, manipulating the flows through this infrastructure lowered the Euphrates levels and made it easier for troops to cross in many places, making it easier for them to move around and fight against Iraqi forces (Securing Europe, 2015). These operations bolster a fundamental thesis: in scenarios where water infrastructure is centralized and scarcity is exacerbated by climate and conflict, dominion over hydraulic chokepoints serves as a force multiplier for non-state actors. As discussed in Chapter 4, the political economy and state-building paths of the region have led to concentrated infrastructure and governance bottlenecks. Insurgent groups can take advantage of these situations to create wide-ranging coercive effects at a relatively low military cost (Lambert & Rioux, 2014; Richter et al., 2019). ISIS's hydro-insurgency turned dams into two-way tools: they could be used to force enemies to do what they wanted and to send messages to people living in areas they controlled (Daoudy, 2020).

5.2.3 Contamination, sabotage and destruction of water systems

ISIS didn't just use dams and barrages to control the flow of water. It also contaminated, sabotaged, and purposefully destroyed water treatment plants, pumping stations, and distribution networks in Iraq and Syria from 2014 to 2017. These actions make it hard to tell the difference between environmental sabotage and regular military targeting. They show how relying on infrastructure can make people vulnerable when their survival is linked to centralized systems (Gleick, 2019; Reininghaus et al., 2019).

In December 2014, ISIS allegedly tainted drinking water in the Balad district of Iraq’s Salah al-Din governorate by injecting crude oil into the municipal water system, making it undrinkable and forcing civilians to look for other, often dangerous, sources (von Lossow, 2016; PAX Protection of Civilians, 2018). Other reports talked about supposed poisoning or contamination events in Aleppo, Deir ez-Zor, Raqqa, and Baghdad. These were framed as acts meant to scare noncombatants and make people lose faith in the ability of the other side to provide services (von Lossow, 2016; Krzymowski, 2021). In conflict zones with broken information, it can be hard to figure out who poisoned who in specific cases. However, the overall pattern fits with ISIS's strategy of using essential services as a weapon to strengthen their rule and gain psychological dominance (Schillinger et al., 2020).

The analytical distinction posited by Reininghaus et al. (2019) is particularly relevant here: intentional contamination, classified as a form of terrorism within applicable legal frameworks, contrasts with unintentional pollution arising from infrastructural deterioration or negligence. ISIS's contamination incidents, as documented, signify deliberate harm intended to create coercive leverage, setting them apart from incidental environmental damage and bearing consequences for legal attribution, accountability under International Humanitarian Law (IHL), and the formulation of protective norms for water infrastructure in armed conflict (Reininghaus et al., 2019; Daoudy, 2020). ISIS also used scorched-earth tactics when they had to leave an

area. The US State Department (2017) says that the group systematically destroyed or booby-trapped treatment facilities, pumping stations, electrical equipment, hospitals, and schools to keep civilians from coming back and to make their enemies pay for long-term reconstruction costs. In Ba'ashiqah, it was said that large improvised explosive device (IED) belts were put around water wells, pump houses, and pipelines. This made repairs and rehabilitation deadly even after "liberation" (United States Department of State, 2017). One IED belt laid parallel to a critical pipeline posed a constant threat to repair teams, so they had to do specialized demining before they could start working again (United States Department of State, 2017). In this way, eco-weaponization lasted longer than just the conflict: the infrastructure was not only damaged during the fighting, but it also became a long-term security risk, making recovery after the conflict harder and making people more vulnerable to humanitarian crises (Gleick, 2019). These tactics are part of a plan to make military defeat more costly for enemies in terms of politics, economics, and humanitarian issues. ISIS made the effects of conflict on society worse by attacking infrastructure that people need to survive. This led to long-term emergency situations that put a lot of stress on state institutions and made it harder for the international community to respond (PAX Protection of Civilians, 2018). This is in line with King's (2023) strategic view of water weaponization, which is using environmental systems to destroy or disable large areas, populations, or important infrastructure as part of larger political and military goals.

5.2.4 The Tabqa (Lake Assad) and Tishrin Dams (2013–2017; Post-2019 Dynamics)

The Tabqa Dam on the Euphrates, which was finished in 1973 and created Lake Assad, Syria's largest reservoir, is one of the most well-documented cases of ISIS using water as a weapon over a long period of time (Daoudy, 2020; Abbara et al., 2021). ISIS took control of the dam in early 2013, after opposition forces had taken it in late 2012. They held on to it until 10 May 2017, when U.S.-backed Syrian Democratic Forces (SDF) retook it after a long operation (EIP, 2023). Tabqa had an installed hydroelectric capacity of about 824 MW and provided electricity to large parts of northern and central Syria, including Raqqa, which was the de facto capital of ISIS (Renewable Energy World, 2019; Abbara et al., 2021).

Tabqa exemplifies the multifaceted nature of water weaponization, wherein strategic, tactical, coercive, and psychological functions were frequently concurrent rather than sequential (King, 2023; Schillinger et al., 2020). In May 2014, ISIS allegedly redirected water from Lake Assad to Iraq and diminished the flow to Aleppo, a city dependent on Lake Assad for drinking water, thereby exacerbating siege-like conditions (PAX Protection of Civilians, 2018; von Lossow, 2016). The action served several purposes: it cut off supplies to enemy-held areas, showed that ISIS controlled important infrastructure, and showed that they were willing to punish civilians in enemy-controlled areas (Daoudy, 2020). At the same time, ISIS initially boosted electricity production at Tabqa to give Raqqa and the areas around it several hours of power each day. They did this to show that they were good at running the government and to use service provision as a way to show that they were good at running the government (von Lossow, 2016; CIDOB, 2014). This aligns with Daoudy's (2020) conceptualization of weaponization via cooperation and service delivery, wherein provision is strategic rather than altruistic: services are offered to reinforce political authority and foster compliance. But this

"service strategy" ran into problems when hydrological conditions got worse because flows from Turkey upstream dropped and conflict made pumping stations that supplied Aleppo less reliable. ISIS was said to have to limit how much electricity it made to keep reservoir levels high, which shows how hard it is to run non-state governance projects when resources are running low (von Lossow, 2016). During the SDF's offensive in March 2017, ISIS is said to have opened turbines and spillways, which raised the Euphrates River to its highest level in 20 years and flooded farmland downstream (Atlantic Council, 2017; Wikipedia, 2017). This flood made it harder for the SDF to move forward and forced attacking forces into narrow, open routes, such as the dam structure itself (Atlantic Council, 2017). On March 26, 2017, ISIS said the dam was "on the verge of collapse" because of coalition strikes. This led to emergency ceasefire talks between ISIS, the Syrian government, the SDF, and U.S. forces to stop catastrophic flooding (Wikipedia, 2017; EIP, 2023). Subsequent inspections showed that the structure was still sound, but the event showed the psychological side of weaponization: the threat of dam failure scared people in downstream communities and made enemies change their operational tempo (Schillinger et al., 2020; Atlantic Council, 2017).

Tabqa also shows how transboundary hydropolitics and climate change affect weaponization during conflicts and vulnerability after conflicts. After ISIS was driven out and the SDF took over in May 2017, Tabqa's ability to operate reportedly dropped sharply because of less water coming in from upstream Turkish dam management and a drought that lasted for years. According to reports from OCHA, by July 2019, the flow of the Euphrates had dropped by 65 percent, to less than 200 m^3/s, which is well below the 500 m^3/s minimum set in the 1987 Syria–Turkey agreement (Syria Direct, 2020; Maan Center, 2025). Falling Lake Assad levels were linked to falling inflows (Syria Direct, 2020). According to reports, Tabqa only produced about 150 MW by 2020, even though it had an installed capacity of 800 MW. This was because of low flows and poor maintenance. The HPA Center (2024) says that irrigated areas that relied on the reservoir got smaller.

These dynamics since 2019 support a thesis-wide idea: eco-weaponization works on both short- and long-term scales, with upstream hydrological regulation interacting with local conflict trajectories and climate-driven scarcity to make people more vulnerable. Tabqa shows how controlling infrastructure during war creates path dependencies—broken systems, lower technical capacity, and changed hydrological regimes—that make recovery harder long after the fighting stops (Abbara et al., 2021; HPA Center, 2024). The case illustrates that explicit destruction is not a prerequisite for coercive environmental damage; unilateral upstream reductions can serve as indirect coercive mechanisms with humanitarian repercussions akin to direct targeting (Syria Direct, 2020).

The Tishrin Dam near Manbij is another example of how important hydraulic assets are for strategy. ISIS held Tishrin from 2013 to December 2015, when Kurdish and Arab forces backed by the U.S. took it back (Renewable Energy World, 2019). Tishrin had a hydroelectric capacity of about 630 MW and provided electricity to the governorates of Raqqa and Aleppo. It was a valuable asset that was fought over during the entire conflict (Abbara et al., 2021). Control allowed for regulation of electricity provision, just like in Tabqa. This helped governance signal within held territories and allowed for selective denial to enemy areas (Daoudy, 2020). In conflict-affected, water-scarce areas with centralized infrastructure and weak governance, dam management becomes a strategic and tactical asset that everyone wants.

For non-state armed groups engaged in state-building initiatives—such as ISIS's caliphate—control over water and energy infrastructure creates multiple forms of coercive capacity: the capability to inflict humanitarian suffering on adversaries, the capacity to reward constituencies through service delivery, and the ability to project administrative legitimacy to both internal and external audiences (Daoudy, 2020; King, 2023). As climate change exacerbates hydrological stress and infrastructural vulnerability escalates amid prolonged conflict, these dynamics are expected to endure—and possibly intensify—throughout the Middle East and other water-scarce conflict regions experiencing simultaneous governance and climate crises (Gleick, 2019; Schillinger et al., 2020). Section 5.2 illustrated how ISIS utilized water as an insurgent weapon by commandeering and manipulating substantial hydraulic assets—dams, barrages, and treatment systems—to achieve military superiority, governance legitimacy, and psychological coercion. But eco-weaponization in the Middle East goes beyond just controlling major river systems or fighting over key territorial points between states and non-states. In urban siege warfare, a similar but often more immediate method of coercion is used by deliberately breaking municipal water systems that support large numbers of civilians. Transitioning from hydro-insurgency to siege dynamics redirects the empirical emphasis from basin-scale leverage to city-scale life-support infrastructures, while maintaining the fundamental strategic rationale: the utilization of dependence, vulnerability, and institutional fragility to enforce compliance and undermine adversary legitimacy (Abbara et al., 2021; Daoudy, 2020).

5.3 Water in urban siege warfare: Syria and Yemen

The weaponization of water in urban siege contexts represents a unique form of eco-coercion, wherein centralized civilian life-support systems are intentionally manipulated to exert pressure on besieged populations and the authorities purporting to represent them (Abbara et al., 2021; Daoudy, 2020). While upstream infrastructural dominance works through transboundary control and long-term asymmetry, urban water weaponization happens when municipal infrastructure—like pumping stations, treatment facilities, trunk pipelines, distribution networks, and storage reservoirs—that concentrated civilian communities need to survive is targeted, captured, disabled, or made to work conditionally (PAX, 2020; Tignino, 2016). In this context, water systems gain strategic importance due to their position at the convergence of demographic density, infrastructural centralization, and disputed governance: disruption leads to immediate humanitarian impacts, while restoration is politically interpreted as a sign of authority and capability (Abbara et al., 2021; Daoudy, 2020). Siege conditions affect how urban water weaponization works. In cities with broken territorial control and disputed supply lines, controlling certain nodes instead of the whole system can be enough to use coercive leverage, since single points of failure can spread across neighborhoods and sectors (Abbara et al., 2021; PAX, 2020). When people are under siege, controlling access to water can cause public health crises, speed up displacement, and weaken social cohesion. This makes the effects of military pressure stronger while staying separate from direct kinetic violence (Abbara et al., 2021; PAX, 2020). This is one reason why water coercion can work well in long-term urban conflicts where just having more power doesn't always force people to give up or give up land: deprivation changes the civilian environment in ways that change how people negotiate, how they see

legitimacy, and how long they can keep fighting (Gama, 2023; Daoudy, 2020). The situations in Syria and Yemen show how different groups, like state forces, non-state armed groups, and insurgent factions, have used water deprivation as a military tool and a way to run the country (Daoudy, 2020; Gama, 2023).

5.3.1 Water networks in Aleppo and Damascus

The Syrian conflict provides extensive evidence of water infrastructure weaponization across urban theatres, with Aleppo and Damascus offering particularly well-documented illustrations of how multi-actor competition and territorial fragmentation transform municipal water systems into strategic assets (Abbara et al., 2021; PAX, 2020; Daoudy, 2020). In both instances, intentional targeting and the strategic manipulation of pumping stations, treatment facilities, and transmission infrastructure resulted in prolonged deprivation impacting millions, illustrating how water access can serve as a coercive tool against population centers rather than merely as collateral damage of conflict (Abbara et al., 2021; PAX, 2020).

Aleppo's water vulnerability stemmed not only from exposure to violence but also from the spatial distribution of supply infrastructure across areas controlled by hostile entities. The city's pre-war system, which served about three million people, relied on a multi-stage chain. Extraction and pumping took place at Al-Khafseh on the Euphrates, intermediate handling happened at the Suleiman Al-Halabi station, and final distribution nodes stayed under regime control (PAX, 2020; Abbara et al., 2021). By 2014, this chain had broken along the frontlines: ISIS was in charge of Al-Khafseh, Jabhat al-Nusra was in charge of Suleiman al-Halabi, and the Syrian government was in charge of the terminal facilities. No one person had the ability to run the whole operation, but each had the power to stop it from happening. This made it possible for weapons to be systematically used through selective interruption (PAX, 2020).

Water disruption became a scalable pressure tool in this situation, and it could be turned on with just a few actions. The first major large-scale interruption happened in September 2012 when fighting damaged an important transmission pipeline, leaving about three million people without power for several days (BBC, 2012; Abbara et al., 2021). In the beginning, it was hard to say where the damage came from because it was linked to bombardment and clashes near the Hanano barracks. However, later episodes showed more and more patterned interference instead of random battle damage (BBC, 2012). In 2014, when ISIS was in charge of Al-Khafseh, several shutdowns affected between 200,000 and 300,000 people living in areas controlled by the opposition. Humanitarian observers said that these shutdowns were meant to interfere with civilian supply (PAX, 2020; Abbara et al., 2021). The strategic advantage resided in the disparity between the effort needed to disrupt a node and the magnitude of subsequent damage inflicted in a city reliant on municipal networks.

This logic became stronger as actors used interdependence between hostile zones to force each other to do things. In September 2016, attacks on water infrastructure that were done in response to other attacks affected about two million people. The Syrian government and Russian forces attacked the Bab al-Nayrab pumping station in eastern Aleppo, cutting off water to about 250,000 people. Then, opposition forces shut down the Suleiman al-Halabi station, which, even though it was in opposition territory, supplied water to 1.5 million people in western Aleppo (UNICEF, 2016; Abbara et al., 2021). In this setup, each side could punish

civilians on the other side's side, and the infrastructure made water a hostage for both sides. Humanitarian organizations made it clear what the consequences were in legal terms. Oxfam's coordinator said that deliberately targeting water supply, whether by hitting facilities or cutting off water, is a war crime (Oxfam, 2016). In addition to physical damage, other tactics like contamination and the removal or sabotage of important equipment made things even worse. Reports say that ISIS polluted water in several governorates and stole electrical parts and pumping equipment, which made operations less reliable than just shutting down (Abbara et al., 2021; PAX, 2020). By 2016, cumulative damage and disruption had reportedly reduced access to safe water across Syria by roughly 50 percent, with Aleppo experiencing acute degradation because multiple battle lines intersected its key supply nodes (Abbara et al., 2021). By 2016, cumulative damage and disruption had reportedly reduced access to safe water across Syria by roughly 50 percent, with Aleppo experiencing acute degradation because multiple battle lines intersected its key supply nodes (Abbara et al., 2021). Abbara et al. establish a correlation between infrastructure attacks and quantifiable health outcomes: the rise in diarrheal disease incidence was associated with disruptions, with children under five representing nearly fifty percent of reported cases, suggesting that public health ramifications served as force multipliers for coercion rather than mere secondary effects (Abbara et al., 2021).

Aleppo shows how fragmented multi-actor control can lead to weaponization, while Damascus shows how siege tactics aimed at a concentrated strategic node can cause crises on a metropolitan scale. The Ain al-Fijah spring complex in Wadi Barada provided about 70–80 percent of the water for Damascus. It served more than 5.5 million people in the capital and the surrounding governorate (UN Human Rights Council, 2017). Opposition forces took control of the valley in 2012, and from 2014 to 2017, government forces put the villages that controlled the spring under siege and limited UN and humanitarian access (Syria Direct, 2017). The strategic implication was clear: having control over one essential source gave you power over the whole metropolitan area.

On December 23, 2016, Syrian government and allied forces began an air and ground attack that damaged Ain al-Fijah's infrastructure and stopped water from flowing to Damascus (UN Human Rights Council, 2017; Wadi Barada offensive, 2017). The government said that opposition forces had polluted the spring with diesel fuel and that military action was needed to "liberate" the water source from "terrorists" (Syria Direct, 2017). The UN Independent International Commission of Inquiry on Syria, on the other hand, found no proof that rebels intentionally contaminated or destroyed anything and said that government airstrikes cut off the supply (UN Human Rights Council, 2017). The Commission said that attacking the water installation was a war crime under IHL because it is against the law to attack things that are necessary for civilians to survive (UN Human Rights Council, 2017; BBC, 2017). The Wadi Barada campaign had effects that were both short-term and long-term. The siege and bombardment reportedly killed about 200 people, 60% of whom were women and children. It also forced about 45,000 people to leave their homes and left people in the Damascus area without reliable water for more than four weeks (Syria Direct, 2017). Opposition sources said that the deprivation was part of a larger siege strategy that included encircling the area so tightly that no one could get in, bombing civilian infrastructure (including hospitals), and using civilian suffering to force surrender (Syria Direct, 2017). In this context, lack of water acted as a siege

amplifier: it made the humanitarian costs of encirclement worse and put more pressure on communities whose ability to survive depended on having constant access to basic services. In addition to being used to target sieges, water distribution in areas controlled by the government was said to be a way to manage politics. PAX has gathered testimonial evidence that shows that neighborhoods that were thought to be loyal, often with a strong military presence, got more consistent supplies. On the other hand, areas that were thought to be sympathetic to the opposition had restrictions (PAX, 2020). This pattern corresponds with Daoudy's (2020) "domination and legitimacy" framework: the provision of water transforms into performative governance, whereas deprivation is ascribed to the illegitimacy of the adversary. The same two-way logic worked for all types of actors. For example, ISIS kept the power on in areas it controlled to show that it was a good government, even though it used water flows against areas held by its enemies (von Lossow, 2016; Daoudy, 2020). Urban siege contexts demonstrate that eco-weaponization includes not only strikes and shutdowns but also administrative control over access regimes within contested sovereignty (Daoudy, 2020; Gama, 2023).

5.3.2 Yemen's water infrastructure under attack (2015–Present)

Yemen exemplifies how prolonged deterioration and deliberate targeting of water and sanitation infrastructures result in escalating humanitarian crises via both direct deprivation and indirect epidemic dynamics (Ballard Brief, 2021; Qadri et al., 2018). Since March 2015, airstrikes, artillery, and ground operations have made Yemen's water systems less reliable. This has led to widespread service failures and combined with existing water stress to have negative effects on health, displacement, and the credibility of the government (WHO, 2024).

UN reports show that the sector has suffered a lot of damage. Between 2011 and 2023, about two-thirds of water treatment plants, half of pumping stations, and one-third of storage towers were damaged or destroyed, with the most damage happening between 2015 and 2017 during the air campaign (Hevdesti, 2023; Ballard Brief, 2021). OCHA said that 119 coalition airstrikes broke international humanitarian law because they hit civilian infrastructure, such as water systems (Ballard Brief, 2021). Documented incidents include a February 2016 strike on a reservoir serving about 30,000 people, 2015 strikes on a water tank and an Oxfam warehouse in Sa'ada, damage to hospital water supply infrastructure, and strikes on water-related facilities in Taizz and Hajjah that resulted in civilian casualties (Ballard Brief, 2021).

Investigations that were open source added more specific information. Bellingcat used satellite images and metadata to show that a working desalination plant near Mokha was hit in 2016 and that it had been supplying Houthi-controlled areas nearby before it was destroyed (Ballard Brief, 2021). Although coalition representatives disputed particular attributions, the overall trend—damage across multiple governorates, repeated strikes on civilian facilities, and a focus on disputed urban areas—substantiates an interpretation of systematic pressure rather than merely incidental collateral damage (Ballard Brief, 2021; SIPRI, 2023).

Yemen's infrastructure degradation was especially bad because the country was already weak before the war. Before 2015, almost half of the people didn't have reliable access to clean water, and it was already thought that Sana'a would be the first capital city to run out of groundwater (Dureab et al., 2018). Conflict made this baseline stress worse by causing

secondary problems: damage to electricity infrastructure and fuel shortages made pumping less effective; treatment failures contaminated groundwater; and sewage systems breaking down made people more likely to get sick from water-borne diseases (Dureab et al., 2018; International Medical Corps, 2023). Reports from 2018 said that urban groundwater was contaminated with sewage all over the place and that more than half of the people living there did not have access to WASH services (Dureab et al., 2018; International Medical Corps, 2023).

The most significant indirect consequence of the collapse of Yemen's water system was the widespread emergence of epidemic diseases. Yemen experienced what is widely described as the largest cholera epidemic in modern history, with more than 2.5 million suspected cases and over 4,000 deaths reported between October 2016 and 2022 (WHO, 2024; Yemen cholera outbreak, 2017–2022). Yemen had 84% of the world's cholera cases in 2017 and 93% in 2019. As of December 2024, it was still the country with the most cases, with 35% of the world's cases and 18% of the deaths (WHO, 2024). The executive directors of UNICEF and WHO made it clear that this disaster was caused by a system failure caused by conflict. The outbreak was seen as a direct result of war that cut off 14.5 million people from regular access to clean water and sanitation (UNICEF/WHO, 2017).

Epidemiological research substantiated this mechanism. The sharp rise in cases in April 2017—over 50,000 per week—happened at the same time as seasonal rains that polluted water sources and the war-related breakdown of sewage and municipal systems (Qadri et al., 2018; Lessler et al., 2018). Field reporting referenced in Lessler et al. (2018) indicated that the resurgence commenced shortly after the failure of Sana'a's sewage system, attributed to electricity shortages and maintenance breakdown following the suspension of public salaries. Microbiological analysis indicated that the 2017 wave did not necessitate the introduction of a new strain; rather, it was propelled by the increased transmission of previously seeded bacteria. This exemplifies how infrastructural failure transformed endemic risk into an epidemic surge when environmental factors, such as rainfall, interacted with sanitation deficiencies (Lessler et al., 2018). From a strategic standpoint, the significance lies not in the intentionality of epidemics, but in their manifestation as predictable cascading consequences of deteriorating WASH infrastructure within a context of high vulnerability. These health crises overwhelmed governance capacity, strained humanitarian response, and eroded civilian confidence in local authority structures—outcomes that can function as force multipliers for coercive pressure in protracted conflict environments (Qadri et al., 2018; WHO, 2024). Malnutrition made people more vulnerable; vaccination coverage dropped from 70–80 percent before the conflict to 54 percent by 2018, which led to the return of other diseases; and by 2023, suspected diphtheria cases rose sharply (Salem et al., 2025). The outcome is best described as a cumulative deterioration of societal resilience, resulting from the failure of infrastructure in conjunction with a broader collapse of wartime governance.

The legal status of attacks on water installations and deprivation strategies is clear in theory but disputed in practice, similar to the situation in Syria. It may be hard to prove direct intent in some cases, but the ongoing damage to important civilian facilities and the predictability of humanitarian outcomes raise serious questions about the principles of distinction, proportionality, and precaution (SIPRI, 2023; Ballard Brief, 2021). Article 54 of Additional

Protocol I forbids attacks on things that are necessary for civilians to survive, such as drinking water installations and supplies. This is true whether the goal is to deprive civilians or gain a military advantage (Tignino, 2016; Geneva Academy, 2020). Yemen exemplifies a fundamental issue in modern eco-weaponization governance: even in cases of contested intent, cumulative effects may effectively equate to intentional coercion through deprivation in situations of acute baseline vulnerability (Tignino, 2016; SIPRI, 2023).

5.3.3 The siege of Taiz

The Houthi-imposed siege of Taiz serves as a salient example of blockade strategies that obstruct humanitarian access, including water, functioning as mechanisms of urban siege warfare (Euro-Med Monitor, 2023; Mwatana, 2015). The siege, which started in the middle of 2015 and lasted for years, put almost three million people under strict limits on their movement and the entry of food, medicine, and water. This made deprivation a part of the conflict's bargaining process (Euro-Med Monitor, 2023; HRW, 2024).

Water deprivation in Taiz was achieved through multiple overlapping mechanisms, including the closure of critical supply routes, checkpoint interdiction of water deliveries, limitations on access to wells beyond besieged districts, and the confiscation of supplies (Ballard Brief, 2021; Mwatana, 2015). Yemeni human rights groups got testimony that civilians were regularly stopped from getting water, and in some cases, their water was taken away at checkpoints (Ballard Brief, 2021). These limitations were not confined to municipal supply interruptions; they also precluded alternative procurement pathways, thereby converting scarcity into a mandated state. Documented incidents recorded the routine coercion inherent in these practices. Mwatana said that on October 7, 2015 a fighter urinated into the tank of a commercial water truck that was stopped at a checkpoint in Berbasha (Mwatana, 2015). Even if these actions can't be directly linked to policy at the command level, they show how water access restrictions can be used to scare and dehumanize people, which makes coercive messaging even stronger. Quantitative indicators highlight the magnitude of deprivation. Euro-Med Monitor says that the Taiz Water and Sanitation Local Corporation's annual water supply went from about 6.12 million cubic meters before the siege to 648,000 cubic meters after it—an 89 percent drop (Euro-Med Monitor, 2023). Residents reportedly received piped water roughly once every 45 days on average, pushing households toward expensive tanker supplies that many could not afford and effectively pricing water access beyond the reach of the most vulnerable (Ballard Brief, 2021; Euro-Med Monitor, 2023).

Early in the siege, UN officials called the situation a "virtual state of siege," saying that vulnerable civilians were in desperate need of drinking water, medical supplies, and life-saving help (BBC, 2015). Reports from humanitarian coordination showed that aid convoys were repeatedly blocked and that there were long waits at checkpoints. They also said that only a small amount of aid was allowed in and that aid was being diverted away from its intended recipients (BBC, 2015). Euro-Med Monitor's 2023 report called the siege a form of collective punishment that could be a war crime because it systematically blocked access to basic needs like water (Euro-Med Monitor, 2023). The strategic purpose of these limitations was entrenched in a prolonged stalemate: in the absence of a definitive victory on the battlefield, deprivation affected civilian resilience and exerted pressure on rival forces and governance frameworks through the gradual erosion of social reproduction (HRW, 2024; Euro-Med Monitor, 2023).

Taiz also shows that water coercion doesn't usually work on its own. Food prices went up compared to those in other cities; schools closed; roads were damaged; and dangerous detours led to civilian deaths in traffic accidents (Euro-Med Monitor, 2023). This aligns analytically with the previously established "cascading vulnerabilities" framework in the thesis: limiting water access gains strategic significance when integrated into a broader deprivation framework that undermines all aspects of civilian resilience, including health, education, mobility, and livelihoods.

In Aleppo, Damascus, Yemen's urban centers, and Taiz, the empirical pattern is the same: in urban siege warfare, water is used as a weapon by strategically manipulating centralized infrastructures and access routes that are essential for civilian survival (Abbara et al., 2021; Daoudy, 2020; Euro-Med Monitor, 2023). Various actor types utilize analogous strategies—shutdowns, node targeting, blockade restrictions, conditional access, and selective provision—suggesting that urban water coercion is not ideologically driven but rather a reflection of the calculated assessment of water's coercive value in contexts of infrastructural dependence (Daoudy, 2020; Gama, 2023). The situations in Syria and Yemen show that indirect effects, especially how diseases spread, are not minor effects but important ways that eco-coercion gets strategic leverage over time (Qadri et al., 2018; Abbara et al., 2021). The collapse of public health overwhelms institutions, undermines the legitimacy of governance, and diminishes civilian resilience, thereby intensifying pressure in ways that kinetic operations alone frequently cannot endure (WHO, 2024; Qadri et al., 2018). Lastly, these cases show that there is still a big difference between what the law says is illegal and what is actually illegal. International humanitarian law safeguards essential objects for civilian survival; however, enforcement is inadequate in fragmented sovereignty contexts, characterized by contested attribution, restricted accountability mechanisms, and significant strategic incentives to manipulate infrastructure (Tignino, 2016; Geneva Academy, 2020; SIPRI, 2023).

5.4 Forced water deprivation in Gaza

5.4.1 Structural water inequalities

The chronic lack of water in Gaza and the rest of the occupied Palestinian territory cannot be seen as a simple technical problem or a side effect of dryness. Instead, the literature places it within a long-term framework of control where Israeli legal-administrative authority and material dominance dictate access to aquifers, infrastructure development, and system maintenance (Daoudy, 2020; Paula Duarte Lopes et al., 2025). In terms of hydro-hegemony, this is not just an unfair distribution of resources; it is the institutionalization of dependency through methods that limit Palestinian authorities adaptive capacity while strengthening Israeli control over important environmental systems (Zeitoun & Warner, 2006; Hayat et al., 2022). The 1993–1995 Oslo process, and especially the Oslo II Interim Agreement, which set up a system for allocating and governing resources that made the framework itself unequal, was a key turning point in this institutional setup (Amnesty International, 2009). According to Oslo II, about 90% of shared water resources went to about seven million Israelis, while about 10% went to 3.5 million Palestinians in the Gaza Strip and West Bank (Geneva Policy Outlook,

2024). This allocation was clearly meant to be temporary, lasting only five years, but it has been in effect for almost thirty years now, serving as a de facto permanent baseline despite population growth, development needs, and the lack of a long-term political settlement (Palestine Australia, 2016). The enduring nature of a "temporary" arrangement is analytically important because it changes what could have been called transitional governance into structural constraint. This has long-term effects on planning infrastructure, investment horizons, and resilience strategies. The Joint Water Committee (JWC) was set up by Oslo II to coordinate water management. In the dossier, it is often described not as an equalizing body but as a veto mechanism that makes Israeli bargaining power work within a formally cooperative structure (Amnesty International, 2009; Jägerskog, 2009). Because decisions need agreement, the committee gives Israel the power to block Palestinian projects on its own while also making it easier for water infrastructure projects linked to Israeli settlements in the occupied West Bank to get approval at the same time (Palestine Australia, 2016). From 1995 to 2008, Palestinian requests for new wells in the Western Basin of the Mountain Aquifer, which is one of the most productive shared groundwater bodies, were repeatedly turned down. On the other hand, Israeli extraction from the same aquifer reportedly continued without JWC approval and exceeded agreed allocations by more than 180 percent (Palestine Australia, 2016). In this setup, cooperation works procedurally, but the way decision-making power is shared is still not equal. These institutional limitations result in varied consumption patterns and unequal experiences of scarcity. According to B'Tselem (2014), Palestinians in Area C of the West Bank consume about 20 liters per person per day, which is only one-fifth of the World Health Organization's recommended minimum of 100 liters. Israelis, on the other hand, consume about 280 liters per day, including in settlements. The spatial politics of infrastructure institutionalize water inequality in the West Bank, prioritizing Israeli settlements through dedicated, high-capacity networks while Palestinian communities nearby face chronic rationing, seasonal restrictions, and costly water trucking (B'Tselem, 2014). Mekorot, Israel's state-owned water company that supplies nearly half of Palestinian domestic water and controls ~70% of West Bank infrastructure, systematically allocates greater volumes to settlements—enabling per capita consumption exceeding 400 liters/day for high-demand uses like irrigated agriculture, pools, and lawns—while reducing Palestinian supplies by up to 50% during summer peaks to meet settler demand (Palestine Australia, 2016; B'Tselem, 2014; Amnesty International, 2009). This discriminatory distribution, documented through Mekorot's own infrastructure data and Joint Water Committee records, exemplifies structural hydro-hegemony rather than isolated incidents (B'Tselem, 2014). The result is not just less overall availability; there is also a structured hierarchy of access built into infrastructure routing and supply governance.

Gaza's water crisis is similar to a structural constraint, but it is caused by a different hydrological dependence, on the Coastal Aquifer. The dossier says that the Gaza Strip depends heavily on this shallow groundwater body, which gets about 45 million cubic meters (MCM) of rain each year (Fanack Water, 2025; UNEP, 2009). But extraction has reached about 185 MCM per year, which is more than four times the sustainable yield. This is because of population growth, limits on alternatives, and a lack of coordinated transboundary governance (Fanack Water, 2025; ANERA, 2022). This ongoing over-abstraction has caused cumulative damage: groundwater levels have dropped below sea level in coastal areas, allowing seawater to enter the aquifer and making 96–97 percent of the water in the aquifer unfit for human

consumption because the salinity is two to eight times higher than WHO guidelines (Fanack Water, 2025; Al-Mezan, 2022). Nitrate pollution makes this salinization worse. Blockade conditions make it hard to get fuel, electricity, and repair supplies, so wastewater management has failed many times, letting untreated sewage seep in. Nitrate levels are reported to be 150–200 mg/L in many places, around three times the WHO limit of 50 mg/L (Fanack Water, 2025).

According to the UN Special Rapporteur (cited in Al-Mezan, 2022), Israeli authorities extract an estimated 75% of the Coastal Aquifer's sustainable annual yield from the Israeli side, reducing the groundwater that can flow into Gaza, and they have reportedly constructed about 27 "trap wells" along Gaza's eastern border to intercept groundwater before it reaches the Gaza section of the aquifer (Ghannam, cited in The New Humanitarian, 2009). UN warnings in 2012 indicated that the aquifer could be permanently damaged by 2020 if extraction patterns continued, and this threshold is now widely regarded in the literature as having been crossed (UN OCHA, cited in Al-Mezan, 2022). Taken together, these dynamics can be understood as showing that structural water inequality arises not only from administrative regulation but also from hydrological engineering that redistributes flows and constrains the adaptive capacity of a dependent population. In this sense, the documented patterns of over-abstraction, interception of flows, and institutionalized control over water infrastructure align with hydro-hegemony analyses of resource capture and infrastructural domination, wherein legal frameworks, institutional design, and material chokepoints reinforce long-term control and limit downstream options (Zeitoun & Warner, 2006; Warner, 2008). Within this framework, Israel's leverage operates on several levels—material (infrastructure monopoly and enforcement capacity), bargaining (veto authority through the JWC), and ideational (framing scarcity as a natural condition rather than as politically structured)—embedding deprivation within governance arrangements that normalize asymmetry and complicate questions of intentionality (Warner, 2008; Hayat et al., 2022; Daoudy, 2009; Lambert & Rioux, 2014). In such a setup, water insecurity appears not as a temporary disruption but as a stable structural condition that can be intensified and mobilized in political arenas.

5.4.2 Blockade and infrastructure destruction (2023–present, with earlier precedents)

Since October 2023, records have described a set of overlapping mechanisms that fit with the eco-weaponization typologies that were mentioned earlier in the thesis. These mechanisms include deprivation through denial of inputs, physical damage, and limits on repair and maintenance (Daoudy, 2020; Grech-Madin et al., 2025). The evidence base shows three main patterns: (i) siege-style input cutoffs that made water systems unusable, (ii) large-scale destruction and disabling of WASH infrastructure during military operations, and (iii) long-term restrictions on fuel and electricity that made recovery impossible even when facilities were still physically intact.

(1) "Complete siege" measures: cutting off water, fuel, and electricity, as well as shutting down desalination and sanitation systems.

Israel reportedly cut the three Mekorot pipelines that bring water from Israel to Gaza on October 9, 2023. This cut off about 12% of Gaza's total water supply and more than half of its drinking water (HRW, 2024; Oxfam, 2024). At the same time, Israel cut off electricity to Gaza, which shut down the only power plant there and made it impossible for desalination plants, wastewater

pumping stations, and water wells that need constant power to work (UNEP, 2024). As of mid-November 2023, evaluations showed that all five wastewater treatment plants and most of Gaza's 65 sewage pumping stations had stopped working because they had run out of fuel and electricity (CSIS, 2024; UNEP, 2024).

The humanitarian effects described are immediate and serious. According to HRW, water production had dropped to 5.7 percent of pre-7 October levels by February 2024. UN OCHA estimates that only 10–25 percent of production capacity could be maintained through mid-2024 (HRW, 2024; UN OCHA, cited in HRW, 2024). Reportedly, about 70% of Gaza's population drank salinized or contaminated well water, and the city's water supply dropped to very low levels—about 1,000 m^3 per day for Gaza City when it needed about 150,000 m^3 per day (OHCHR, 2023; Syria Direct, cited in PAX, 2020). Oxfam predicted that by November 2024, the overall water supply would have dropped by 94% compared to what it was like before the conflict. They also said that about 80% of the water that was produced would have been lost due to leaks in damaged distribution networks (Oxfam, 2024; HRW, 2024). People keep saying that these signs show that the system is being pushed too far, from service disruption to systemic collapse. As of February 2026—100 days after the ceasefire—Oxfam confirms these predictions have materialized, with 84.6% of Gaza's water infrastructure destroyed or damaged and production at just 5-6% of pre-war levels, marking full systemic collapse (Oxfam, 2026; HRW, 2025).

(2) Damage and destruction of pipelines, wells, reservoirs, and wastewater networks during military operations.

A second way is to physically damage water and sanitation infrastructure through military operations. Using satellite images, verified video, and on-the-ground assessments, HRW and UNEP show that systematic destruction is happening (HRW, 2024; UNEP, 2024). The World Bank and Ipsos say that by January 2024, almost 60% of Gaza's water and sanitation infrastructure was damaged or destroyed. By August 2024, that number had risen to 84.6%. The report lists a number of well-known events that are often used to back up claims of intentional targeting rather than accidental damage:

- Satellite images showing bulldozer tracks and the destruction of solar panels that power wastewater treatment plants. In particular, the destruction of photovoltaic arrays linked to four of Gaza's six wastewater treatment plants (HRW, 2024);
- Verified video showing Israeli soldiers putting explosives inside a main water reservoir in Rafah and blowing it up, shown as proof of planned destruction (HRW, 2024);
- The destruction of a seawater desalination plant that served northern Gaza and Gaza City. It was shown to be intact in April 2024 images but destroyed by early May 2024 (BBC Verify, 2025);

More than 60 municipal wells were damaged, and Gaza's three desalination plants were partially or completely shut down. By the end of 2023, two of them were only operating at about 25% capacity because they didn't have enough fuel (Dutch Scholars for Palestine, 2023).

According to Oxfam, between October 2023 and June 2024, water and sanitation infrastructure was taken out of service at an average rate of five facilities every three days (Oxfam, 2024). UN-linked assessments say that the pace of loss is systematic. Asi et al. introduce a spatial-statistical perspective, contending that the aggregation of damage contradicts random

distribution, thereby endorsing the inference of strategic prioritization of WASH assets within the overarching framework of hostilities (Asi et al., 2024).

(3) Limits on fuel and electricity as a long-term problem for operations and repairs. The dossier stresses that limiting energy inputs can be an indirect way to use weapons by making infrastructure that is still standing unusable (OHCHR, 2023; Oxfam, 2024). Action Against Hunger (2025) says that Gaza's water system needs about 70,000 liters of fuel every day to run desalination, sewage pumping, and distribution networks. But the amount of fuel that was reportedly allowed has averaged around 23,000 liters per day, and full blockages have lasted for weeks (OHCHR, 2023; UNEP, 2024). Amnesty International says that in March 2025, Israeli officials cut off the Southern Gaza desalination plant from the Israeli electricity grid, which cut its output by 85 percent, from 18,000 m^3 per day to 3,000 m^3 per day (Amnesty International, 2025). These limits are seen as very important because they affect both current operations and the ability to recover. For example, without fuel, electricity, and parts, the system can't be stabilized even if the facilities are still standing.

Humanitarian organizations say that the interaction of these mechanisms has led to a "deliberately produced water catastrophe," in which deprivation is caused by coordinated control of many inputs instead of just one act of destruction (OHCHR, 2023; Oxfam, 2024). By the middle of 2024, estimates from the UN said that about 89 percent of water and sanitation infrastructure had been damaged or destroyed. This meant that most households did not have access to clean water (UNEP, 2024; UN Experts, 2025). Reports say that untreated sewage—around 130,000 m^3 per day—has flowed into streets, coastal waters, and aquifers. This has made it easier for waterborne diseases like cholera, dysentery, and hepatitis to spread (UNEP, 2024; CSIS, 2024). In this context, the breakdown of sanitation is not a separate crisis, but rather an integral component of the water weaponization dynamic, as contamination and sewage overflow directly compromise potable water supply and exacerbate public health risks.

These events have become very important in legal discussions about using deprivation and starvation as weapons of war. Overall, Sections 5.4.1 and 5.4.2 show the main idea of this thesis: long-term hydro-hegemonic control built into legal and administrative systems can exist alongside—and create the conditions for—acute coercive deprivation used as a method of warfare (Zeitoun & Warner, 2006; Daoudy, 2020). Gaza is a good example of how demographic pressure, aquifer degradation, and weak infrastructure make people more vulnerable. Asymmetric power and weak enforcement, on the other hand, let deprivation continue with little effective constraint (Hayat et al., 2022; Paula Duarte Lopes et al., 2025).

5.5 Domestic eco-coercion: The Iranian case

Eco-weaponization is not limited to interstate hydropolitics. In domestic political systems, the distribution of environmental resources can become a form of coercive governance, particularly where central authorities retain discretionary control over infrastructure planning, inter-regional transfers, and access to essential services. Iran’s long-standing reliance on large-scale dam construction and inter-basin transfer schemes—most notably the diversion of water from peripheral provinces such as Khuzestan toward politically and economically prioritized central

regions—illustrates a form of domestic eco-coercion: the deliberate reconfiguration of hydrological systems to consolidate state authority, privilege favored constituencies, and subordinate peripheral regions (Barnes, 2009; Lambert & Rioux, 2014). The Iranian case therefore indicates that eco-weaponization can extend beyond transboundary bargaining to encompass intrastate governance frameworks in which environmental allocation is integrated into authoritarian political economies and deployed as a mechanism of political control (Richter et al., 2019).

The current water crisis in Iran is frequently attributed to climate change, including reduced precipitation, recurrent droughts, and increasing temperatures. The literature cited in the dossier, however, places primary explanatory weight on governance: decades of overbuilding, mismanagement, and rent-seeking have prioritized political and economic objectives over hydrological sustainability (Madani, 2014; Kelley et al., 2015). These policies were pursued under strategies of food self-sufficiency, industrial expansion, and territorial integration. Policymakers have framed large-scale hydraulic projects as "national development," "efficiency gains," "equitable redistribution," and "resilience building," yet these technocratic rationales obscure core political functions: concentrating control over vital resources in state or elite hands, entrenching long-term dependencies, and channeling economic rents through state-managed procurement and restricted access (Lambert & Rioux, 2014; Richter et al., 2019). In this sense, hydrological engineering constitutes political engineering, structuring power asymmetries under the guise of technical necessity.

Khuzestan is central to this domestic hydropolitical geography. Despite being described as holding approximately one-third of Iran's surface water resources and containing major rivers such as the Karun, Karkheh, and Dez, the province has experienced acute water insecurity due to upstream dam operations and sustained inter-basin transfers toward central provinces such as Isfahan and Yazd (İRAM Center, 2022). The dossier identifies multiple projects that operationalize this diversionary logic. The Kouhrang tunnel system, initiated in 1987 and developed in successive stages, illustrates the long temporal horizons of transfer infrastructures. Kouhrang 2 reportedly transfers approximately 255 million m³ annually from Karun tributaries to Isfahan, while Kouhrang 3 (still under construction) is intended to further increase this capacity. The Beheshtabad tunnel is presented as a larger project intended to transfer approximately 770 million m³ toward Kerman, Yazd, and Isfahan (NCRI, 2023). Additional transfer infrastructures cited include the Kamal Saleh Dam (approximately 100 million m³ to Qom, operational since 2011) and the Cheshmeh Langan tunnel (approximately 195 million m³, operational since 2005), both channeling water from Khuzestan's basin toward cities, industries, and irrigated agriculture on the central plateau (NCRI, 2023). The analytical significance lies not merely in the volumes transferred but in how these infrastructures reorder political geography by establishing whose water security is rendered non-negotiable and whose is made contingent.

It emphasizes that these transfers serve interconnected economic and political purposes. Economically, they support water-intensive industrial production in central provinces, including sectors linked to politically connected conglomerates and—according to sources cited—entities associated with the Islamic Revolutionary Guard Corps (IRGC), with Mobarakeh Steel Company frequently referenced as emblematic of high-consumption industrial demand in Isfahan (NCRI, 2023). The political economy of construction and

operation is also relevant: dam and transfer projects channel procurement, contracts, and rents through institutions close to the state's executive and security core, reinforcing centralized authority over allocation decisions (İRAM Center, 2022; NCRI, 2023). Politically, this resembles a rentier logic applied to water governance. Where hydrocarbon rents reduce reliance on taxation and negotiation, control over water infrastructure can stabilize politically central regions through engineered supply and thereby reduce dependence on peripheral consent, bolstering authoritarian autonomy from affected constituencies (Richter et al., 2019; Lambert & Rioux, 2014). The mechanism is not scarcity alone, but the capacity to determine whose scarcity is politically consequential.

These distributive effects have repeatedly manifested as social mobilization in Khuzestan. In July 2021, protests erupted across the province in response to prolonged shortages affecting hundreds of villages. Protesters framed the crisis as a "manufactured drought," attributing deprivation to state dam-building and flow reconfiguration rather than climatic inevitability (Human Rights Watch, 2021; Wikipedia, 2021). The protests—often referred to as the "Uprising of the Thirsty"—spread from rural areas near Ahvaz to major cities such as Ahvaz, Mahshahr, Shush, and Susangerd, and generated solidarity protests in Tehran, Kermanshah, Isfahan, and other provinces (Wikipedia, 2021). Human rights reporting indicates the use of lethal force and mass arrests, including at least 18 local activists and more than 300 detainees (Human Rights Watch, 2021; IranWire, 2022). Within the analytical frame of this thesis, repression is not merely an external overlay but an enforcement mechanism that stabilizes an allocative order when contestation emerges.

It underlines that these grievances emerged in a province that is comparatively water-rich, underscoring the political character of deprivation. Reported indicators include approximately 702 villages lacking access to drinking water, the collapse of agricultural livelihoods, livestock mortality, and degradation of wetlands such as the Hawizeh (Hor al-Azim) Marshes (Human Rights Watch, 2021; İRAM Center, 2022). The literature cited attributes these outcomes primarily to deliberate infrastructural interventions: upstream dams regulate flows to facilitate transfer priorities and maximize hydropower generation, while evaporation losses—exacerbated by summer temperatures exceeding 50°C—are described as consuming roughly one-quarter of stored volumes, intensifying the inefficiency of a system publicly presented as "scarcity management" (NCRI, 2023). The dossier also connects hydrological stress to extractive pressures. Oil activities reportedly contributed to wetland loss, with state-affiliated contractors receiving drying rights to facilitate oil infrastructure, illustrating how water governance and hydrocarbon political economy intersect to the detriment of local ecosystems and livelihoods (İRAM Center, 2022).

Institutional design is presented as enabling discretionary allocation. The Ministry of Energy is described as retaining near-complete control over planning and transfer approvals, operating with politically connected deputies and firms linked to security institutions; objections from the Environmental Protection Agency and regional representatives are reportedly overridden (İRAM Center, 2022). Limited transparency, weak enforceable environmental review, and constrained participation reduce institutional friction and facilitate the treatment of hydrology as a policy variable rather than a public-service obligation. In this context, infrastructural control functions as a persistent coercive capacity: it enables the state to

allocate scarcity and relief according to loyalty, rent distribution, and regime security (Lambert & Rioux, 2014; Richter et al., 2019).

Ethno-regional divisions further intensify the politicization of transfers. Human rights reporting describes Khuzestan's large Arab minority as historically marginalized, underrepresented, and excluded from decision-making over resource distribution (Human Rights Watch, 2021; PreventionWeb, 2026). In this context, diversion from Arab-majority regions to Persian-dominated central provinces is characterized by local communities and observers as demographic and economic subjugation that diminishes peripheral autonomy and strengthens central authority (PreventionWeb, 2026). This aligns with broader analyses of authoritarian environmental governance in which resource allocation serves to discipline populations deemed politically unreliable, converting environmental policy into a mechanism for reinforcing ethno-regional hierarchy (Barnes, 2009; Richter et al., 2019).

Climate change acts as an amplifier of domestic coercive capacity by intensifying baseline scarcity and raising the political stakes of allocation choices. As renewable availability declines and hydrological volatility increases, distributional disputes sharpen around which claims are prioritized and which losses are deemed acceptable (Kelley et al., 2015; Bourekba et al., 2021). Estimates cited in the dossier suggest renewable water availability could fall below 667 m^3 per capita by 2025—well below the commonly referenced 1,000 m^3 scarcity threshold—and are used to argue that distributional tensions will intensify, heightening the risk of persistent unrest under opaque governance and political insulation (El-Fadel et al., 2001; Sahour et al., 2020). As alternatives diminish, the coercive value of infrastructural control increases: the authority to allocate becomes more politically consequential.

As a comparative observation within Chapter 5, Iran functions as an intrastate counterpart to the transboundary dynamics examined in the Tigris–Euphrates basin. Turkey's upstream infrastructure generates coercive leverage over downstream Syria and Iraq, while Iran's inter-basin transfer system generates internal asymmetries that prioritize central plateau constituencies over peripheral provinces (Zeitoun & Warner, 2006; Hayat et al., 2022). In both contexts, infrastructural dominance sustains a hierarchical order in which flow regulation incentivizes compliance, secures preferred constituencies, and raises the costs of dissent by linking daily survival to political arbitrariness (Daoudy, 2020; Lambert & Rioux, 2014). The Iranian case thus reinforces a central claim of the thesis: eco-weaponization operates across scales. It encompasses not only interstate bargaining and armed conflict but also domestic governance systems where environmental allocation is used to control and subordinate regions, particularly under conditions of climate stress, centralized infrastructure, and limited accountability (Paula Duarte Lopes et al., 2025; Ide et al., 2020; Bourekba et al., 2021).

Chapter 6: Atmospheric manipulation and emerging climate technologies

This chapter looks at atmospheric manipulation and new climate technologies as a new area of strategic climate politics in the Middle East. In previous chapters, we looked at how eco-weaponization works in land, water, and energy systems. In this chapter, we look at the atmosphere, which is becoming more political and where intervention is technically possible, but governance is weak and attribution is always up for debate. The main point is not that regional actors have "weaponized" the sky in a strict operational sense, but that even small, seemingly civilian actions (such as cloud seeding) can have strategic effects, like making people suspicious of cross-border harm, causing competition before it happens, and creating legitimacy crises that are very important in a region with a lot of water scarcity, geopolitical rivalry, and weak multilateral trust.

6.1 Cloud seeding, regional weather modification, and perceived spillovers

For a long time, people have thought of atmospheric moisture as a naturally flowing and politically neutral resource. Improvements in weather modification challenge that idea by making it seem like precipitation is at least partially controllable, which means it could be challenged (Corry, 2017). In the Middle East, cloud seeding has transitioned from sporadic experimentation to an institutionalized policy tool, particularly evident in the Gulf monarchies. Even when the scientific literature is still split on how effective long-term programs are, the political and security effects are becoming clearer: they show that the state can handle more, raise expectations for technocratic control, and make it easier for people to claim costs that are passed on to others.

The UAE has built the biggest and most regularized cloud-seeding system in the area. Operations started in the early 2000s and became an official national strategy by 2010. They use aircraft-based hygroscopic seeding, usually with potassium chloride and other salts, to target convective clouds. The National Centre for Meteorology and the UAE Research Program for Rain Enhancement Science have helped activities grow in space and time. They used to be mostly around the Hajar Mountains. Saudi Arabia has followed suit with a program that started in 2024 as part of the Middle East Green Initiative (Middle East Institute, 2025). It reportedly uses silver iodide dispersal over the Najd plateau and frames increasing rainfall as a strategic response to scarcity, linking cloud-seeding operations to the broader Middle East Green Initiative launched in 2021 (Radwan, 2022). Gulf governments see cloud seeding as a low-risk, reversible way to adapt to changing conditions that fits with a technocratic style of government. Officials frequently recognize uncertainty while underscoring the critical need to secure freshwater resources. However, this framing is not in line with the fact that atmospheric systems are transboundary by definition. "Sky water," on the other hand, is not well-regulated, which

creates a governance vacuum that makes it easier for politicians to make decisions when they don't know what to do.

This is where perceived spillovers become important for security, even when there isn't much evidence for "precipitation theft" (PLOS Water, 2024). Most of the time, the winds in the Gulf blow systems from the west-southwest to the east-northeast. This puts Iran downwind of operations by the UAE and Saudi Arabia. Iranian officials have said many times that Gulf programs change the weather and make droughts worse. Climatological evaluations consistently dismiss these assertions on evidential grounds; however, their persistence holds analytical significance: attribution disputes may emerge from uncertainty and mistrust rather than from verifiable harm (Rubin & Denton, 2023). In these situations, cloud seeding serves as a political tool, seen as theft, competition, or provocation, regardless of its measurable effect on water flow. Israel's experience shows how different people can interpret strategy in different ways. After decades of cloud seeding, Israeli authorities stopped the operations because they found that they weren't very cost-effective. The difference with growing Gulf investments is less important for what it says about effectiveness than for what it says about competitive imaginations: states upwind may feel the need to act quickly to "secure" rainfall before it crosses borders, while states downwind may see normal variability as coming from outside sources. More speculative proposals, like the UAE's reported idea of using artificial orographic structures to make it rain, can make people think even more that atmospheric intervention is becoming part of long-term security planning, even if these ideas are still just ideas (Dennehy, 2026).

Comparative research demonstrates that these dynamics are not confined to specific regions (Corry, 2017). For instance, disagreements over the Indian monsoon show how shared climate systems can make rival states very worried about their own security. The main risk is not the direct physical effects, but the security problem that comes from taking unilateral action when things are unclear. This is because there are low barriers to experimentation, uncertain results, different views on what is good and bad, and no agreed-upon rules.

6.2 Geoengineering and strategic possibilities

Cloud seeding is limited to certain areas and weather patterns, but solar geoengineering, especially solar radiation management (SRM), could affect the whole planet. Solar radiation management (SRM) refers to proposed large-scale interventions that aim to cool the planet by increasing the amount of sunlight reflected back into space, without removing greenhouse gases from the atmosphere. The main techniques discussed in the literature include stratospheric aerosol injection (releasing reflective particles into the stratosphere), marine cloud brightening (making low marine clouds more reflective), and other schemes to alter Earth’s radiative balance, all of which could have globally distributed climatic effects rather than localized weather impacts (Solar Radiation Modification: NOAA State of the Science Factsheet, 2024). No Middle Eastern country seems to be able to use SRM on its own right now, but research paths, signaling behavior, and possible deployment scenarios are already affecting global security discussions in ways that affect the whole region. A significant political change linked

to climate engineering is the change in how we view weather, which used to be seen as an "act of nature" but can now be blamed for bad things (Nightingale et al., 2014). In a world where we can imagine changing the weather, droughts, floods, or heatwaves could be seen as planned, careless, or caused by something outside of our control, even if there is no evidence to support this. This "blameability" gives rise to a new avenue for escalation: disinformation campaigns, opportunistic elites, or extremist narratives can exploit public uncertainty regarding geoengineering to incite grievance and rationalize retaliation.

The literature largely agrees that SRM is not a viable tactical weapon on the battlefield (Sovacool, Baum, & Low, 2023). Stratospheric aerosol injection, the most talked-about SRM method, has effects that are spread out over space and time; aerosols spread out across latitude bands and eventually hemispheres. These traits make military use less useful when accuracy, control, and effects that happen in a set amount of time are important. Any effort to "target" an opponent would probably lead to a lot of problems, even for the state that started it. Strategic leverage, on the other hand, does not need tactical accuracy. Multiple avenues for indirect coercion are frequently identified in the literature (Sovacool et al., 2023; McLaren & Corry, 2021). First, the credible threat of unilateral deployment can serve as diplomatic leverage: a state (or coalition) may indicate readiness to deploy SRM to sway mitigation commitments, alter negotiation stances, or obtain concessions in larger conflicts. Second, the creation of counter-geoengineering capabilities—ways to lessen or cancel out the effects of SRM—could give countries the power to veto, which would change the way countries deter and compete strategically. Third, cyber sabotage or physical attacks could target SRM-related infrastructure and data systems, such as aircraft, platforms, supply chains, and monitoring networks. Expert survey evidence indicates that a significant minority anticipates military responses to unilateral SRM deployment, including efforts to disrupt operational capacity—risks exacerbated by attribution uncertainty and the feasibility of deniable interference. Historical precedent elucidates the reasons for the persistence of these concerns. Operation Popeye during the Vietnam War showed that changing the environment can be used as a weapon when the right strategic conditions are in place. The current interest of major military organizations in climate-related technologies—often discussed in terms of resilience, logistics, or “command of the commons”—further blurs the lines between civilian climate policy and the development of potential security capabilities.

6.3 Regulatory and ethical ambiguities

A lot of regulatory and ethical gaps make strategic risk even worse. For decades, people have talked about geoengineering research and deployment, but there is still no comprehensive international legal framework for it (Usman, Qamar, & Subhani, 2022). The Convention on Biological Diversity, the London Convention and Protocol, UNCLOS, and ENMOD were all made for different reasons and don't really apply to this situation. Their limitations are disjointed, enforcement is inconsistent, and their theoretical framework is ill-suited to technologies that can generate significant impacts through unilateral or minilateral actions. This lack of clear rules leads to "governance by default," where silence is taken as permission

instead of permission. There is still no clear definition of deployment thresholds, and there is still no clear definition of who has the authority to intervene in shared atmospheric systems. This leads to unequal incentives in practice: technologically advanced states have few restrictions on experimentation, while vulnerable states are more likely to face risks. Ethical problems make the legal problems worse. Consent is key: who has the power to change a shared environment, and what rule do they follow? Distributive justice comes next: SRM is likely to have different effects on different regions, helping some and hurting others. For the Middle East, which is very vulnerable to warming but often not very important in global governance, these differences are politically charged. Moral hazard adds another layer: the idea of a "low-cost" intervention that works quickly can make people less likely to cut down on emissions and make them more dependent on fossil fuels, which makes technocratic control over planetary systems the norm. The paradox of climate engineering is that the things that make it seem efficient (speed, scalability, and technocratic manageability) are also the things that can cause problems, conflicts, and legitimacy crises.

There are many different ideas for how to govern SRM, from multilateral moratoriums to the creation of international agencies under the UNFCCC (Cox et al., 2018; Zürn & Schäfer, 2013). Still, proposals keep running into a problem with scale: governance would have to be open to everyone, legally binding, last for decades, and be able to handle uncertainty, settle disputes, enforce compliance, and change as knowledge changes—something that has never happened before in international relations. Uncertainty about attribution makes enforcement even harder. In a climate system that has already been changed by human activity and natural variation, it may be impossible to separate the effects of interventions. That ambiguity can be used strategically because it can keep real complaints alive and allow for opportunistic manipulation, even when there is no clear cause-and-effect relationship. In other words, perception becomes a security factor.

6.4 Investigating risk and the contradiction of high-leverage climate technologies

The literature increasingly regards research as a strategic endeavor, extending beyond mere deployment scenarios. People have called climate engineering a "dual high-stake" new technology, meaning that both doing something and not doing anything could have terrible effects. In one context, avoiding research is seen as irresponsible because climate risk is rising quickly. In another, pushing research forward makes technologies that could cause major geopolitical and ethical problems seem normal. This dual framing sets climate engineering apart from many earlier technology debates and helps to explain why even small-scale experiments can cause a lot of controversy (Zürn & Schäfer, 2013). Research trajectories are significant as they influence political perceptions as much as technical viability. Modeling assumptions frequently incorporate idealized conditions—century-long collaboration, continuous maintenance, and consistent coordination—that are misaligned with actual geopolitical realities. These assumptions could make choices that are naturally conflict-prone and

distributive less political, while also underestimating the struggle for legitimacy and authority. In this regard, research does not merely react to climate insecurity; it can actively formulate new security paradigms by converting the atmosphere into a domain of anticipatory governance, strategic signaling, and implicit coercion. A persistent issue is technological lock-in (Lin, 2016). Long-term investment, institutionalization, and professional networks can create path dependencies that make future deployment more likely, even if there isn't a lot of agreement. Moral hazard and lock-in work together: the fact that quick action can be taken can make it less likely that emissions will be cut and the economy will change. In the Middle East, where dependence on hydrocarbons is still structurally important, geoengineering may be seen as a way to adapt and a way to keep the current political and economic systems in place during times of stress.

6.5 The limits of international law and governance spillovers

The challenge of governance goes beyond the lack of clear rules against something. International law, in its present state, encounters difficulties with technologies that exhibit low deployment costs, significant uncertainty, and globally dispersed effects. When interventions happen in shared atmospheric systems and their effects are random, delayed, and uneven, legal ideas like state consent, territorial jurisdiction, and harm prevention become less clear. ENMOD forbids hostile environmental modification, but its reach is limited and its enforcement is weak. It doesn't directly address climate interventions that seem peaceful, and it doesn't do much to help with attribution problems that are important to SRM debates. Treaties for protecting marine life and biodiversity only partially limit what can be done. As a result, the legal landscape is fragmented, and unilateral or minilateral action may still be formally unclear but politically destabilizing. This gap between what technology can do and what institutions can do is especially big for SRM. A single state or small coalition could start an intervention, but responsible governance would need legitimacy, transparency, and durability on a scale that is rarely seen in international politics. Proposed solutions—international agencies, moratoria, polycentric governance—remain largely aspirational, and Global South representation (including many Middle Eastern states) is often marginal despite disproportionate exposure to risk. Atmospheric manipulation technologies thus reveal a transformation in climate security dynamics. In the Middle East, cloud seeding shows how even small, scientifically debated actions can cause suspicion between countries, disputes over who is to blame, and uncertainty about strategy. SRM makes these dynamics stronger and adds the chance, no matter how small, of one-sided action with effects on the whole planet. The strategic importance of atmospheric technologies resides not in their direct "weapon" applications, but in the uncertainty, asymmetry, and leverage they generate. Research pathways, governance deficiencies, and perception management assume equal significance to physical impacts. Without strong, inclusive, and legitimate frameworks, atmospheric intervention could turn into a new way to use the environment as a weapon. This doesn't have to be because of open hostility; it could also be because of anticipatory control, coercive bargaining, and making climate uncertainty a political issue.

Chapter 7 – Conclusion

This thesis set out to examine how climate-induced vulnerability reshapes the strategic logic of coercion in the Middle East, transforming environmental systems from background constraints into instruments of power. Rather than treating climate change as a direct cause of conflict, the analysis adopted the amplification framework, understanding climate stress as a catalyst that intensifies pre-existing fragilities, governance weaknesses, and infrastructural dependencies (Sowers et al., 2020; Ide et al., 2018; Bourekba et al., 2021). The central finding of this research is that climate change does not simply increase the risk of instability — it alters the strategic environment in which political and military actors operate. By reducing environmental buffers and increasing infrastructural dependence, climate stress enhances the political utility of environmental manipulation. In doing so, it shifts environmental systems — particularly water and energy — from passive constraints to active domains of leverage.

The empirical chapters identified three recurring patterns of eco-weaponization in the Middle East. First, environmental coercion operates along a continuum that ranges from acute infrastructural attacks to long-term structural domination. In transboundary basins such as the Tigris–Euphrates, hydro-hegemony is exercised not only through overt confrontation but also through infrastructural control, bargaining asymmetry, and ideational framing (Zeitoun et al., 2006; Hayat et al., 2022). Cooperation and domination, as shown through Daoudy's framework, coexist on a coercive spectrum rather than representing mutually exclusive outcomes (Paula Duarte Lopes et al., 2025). Second, non-state actors have integrated environmental systems into insurgent and hybrid strategies. The seizure and manipulation of dams by ISIS demonstrated how water can function simultaneously as a tactical military tool and as a mechanism of territorial governance (von Lossow et al., 2020; Daoudy et al., 2020). Environmental control allowed armed groups to discipline populations, shape displacement patterns, and consolidate political authority. Third, indirect and cumulative degradation often proves more durable than direct destruction. Maintenance denial, selective electricity provision, regulatory obstruction, and blockades can produce severe humanitarian effects without triggering the same level of international scrutiny as airstrikes (Abbara et al., 2021; Al-Hindi et al., 2021). In climate-stressed contexts, even short disruptions can escalate into systemic crises affecting health, agriculture, and displacement (Kohler et al., 2019). Together, these patterns demonstrate that eco-weaponization is not episodic but structurally embedded in regional political economies.

A key theoretical contribution of this thesis is the identification of climate change as a force multiplier for eco-weaponization. Climate stress does not invent new weapons; it increases the efficiency and returns of existing practices. Declining river flows, prolonged droughts, groundwater depletion, and rising demand reduce redundancy and coping capacity (Bourekba et al., 2021; Kelley et al., 2015). As Wodon et al. (2016) describe, vulnerability may manifest not only in displacement but also in "relative trappedness," where populations lack the mobility and resources to adapt. In such environments, environmental manipulation produces disproportionate social and political effects. This amplification logic modifies cost–benefit calculations. The material cost of disrupting infrastructure may remain constant, but the political impact grows as baseline scarcity intensifies. Climate change therefore increases the strategic "return on investment" of environmental coercion (Ide et al., 2018; Kohler et al., 2019). This dynamic underpins what this thesis conceptualizes as strategic climate warfare: the deliberate exploitation of climate-enhanced vulnerability to pursue coercive objectives.

The findings also reveal significant normative and institutional gaps. International humanitarian law prohibits attacks on civilian infrastructure, yet enforcement remains inconsistent and attribution contested (Daoudy et al., 2020; Gama et al., 2023). Climate variability complicates accountability. When river flows decline due to drought, it becomes

difficult to distinguish between deliberate withholding and climatic fluctuation. This ambiguity creates a grey zone in which intentional manipulation can be concealed within systemic degradation. Hybrid warfare frameworks help explain how environmental disruption functions below traditional thresholds of armed conflict (Chiragov et al., 2025). Moreover, cooperative arrangements may institutionalize asymmetry rather than resolve it. As hydro-hegemony scholarship shows, domination can be embedded in treaties, technical standards, and infrastructure design (Zeitoun et al., 2006; Menga et al., 2016). Climate stress intensifies these imbalances by increasing downstream dependence and politicizing allocation decisions.

Eco-weaponization is most likely where three conditions converge: structural scarcity, asymmetric control over environmental systems, and weak institutional constraints. The Middle East exhibits all three. As precipitation patterns shift and droughts intensify (Tabari et al., 2018; Choi et al., 2022), allocation decisions become increasingly politicized. Infrastructure centralization creates chokepoints that can be leveraged strategically. Protracted conflict and fragmented sovereignty weaken enforcement mechanisms. Under these conditions, environmental systems become bargaining instruments as much as survival systems. However, eco-weaponization is not cost-free. Actors seeking long-term governance must maintain minimal service provision, creating tension between coercion and legitimacy (von Lossow et al., 2016). Severe ecological degradation can also undermine economic recovery and generate instability that exceeds initial strategic gains (Bulmer et al., 2018). These contradictions suggest that environmental coercion is most sustainable when embedded in ambiguity rather than overt destruction.

The trajectory of climate projections indicates that environmental stress will intensify across the region. Without institutional adaptation, the strategic value of environmental manipulation is likely to increase. Yet climate change amplifies incentives — it does not eliminate agency. Strengthening basin-wide agreements, improving transparent monitoring mechanisms, decentralizing infrastructure, and reinforcing accountability frameworks can reduce the strategic attractiveness of eco-weaponization. Recognizing environmental systems as potential domains of coercion is a prerequisite for insulating them from manipulation.

Strategic climate warfare in the Middle East reflects the convergence of warming temperatures, infrastructural centralization, and asymmetric power. Environmental systems — particularly water — have become arenas where territorial control, civilian welfare, and political legitimacy intersect. Eco-weaponization is neither an inevitable outcome of climate change nor a novel invention of contemporary conflict. It is a contingent strategy that thrives under conditions of scarcity, dependence, and weak governance. As climate stress intensifies, the strategic leverage embedded within environmental systems will likely grow. The core challenge for regional and international actors is therefore not only to manage climate risk, but to prevent that risk from being transformed into a tool of coercion.

Reference list:

Abbara, A., Blanchet, K., Sahloul, Z., Fouad, F., Coutts, A., and Wasim, M. (2021). Weaponizing water as an instrument of war in Syria. PLOS Water, 1(2), e0000007. Available at: https://doi.org/10.1371/journal.pwat.0000007.

Abbara, A., Blanchet, K., Sahloul, Z., Fouad, F., Coutts, A., and Wasim, M. (2023). Cholera in the time of Assad: How Syria's water crisis caused an avoidable outbreak. The Century Foundation. Available at: https://tcf.org/content/report/cholera-in-the-time-of-assad-how-syrias-water-crisis-caused-an-avoidable-outbreak/.

Abbara, A., Rayes, D., Doocy, S., Sirois, A., Fouad, F. M., Sullivan, N., and Blanchet, K. (2021). Weaponizing water as an instrument of war in Syria. Journal of Public Health, 43(Supplement_1), i10–i17. Available at: https://doi.org/10.1093/pubmed/fdab043.

Abraham, D., Houmb, S. H., and Erdodi, L. (2025). Cyber-attacks on energy infrastructure—A literature overview and perspectives on the current situation. Applied Sciences, 15(17), 9233. Available at: https://doi.org/10.3390/app15179233.

Action Against Hunger. (2025). Gaza: Immense humanitarian needs. Available at: https://www.actioncontrelafaim.org/en/news/press/gaza-immense-humanitarian-needs/.

Adel, M. M. (2013). Upstream water piracy, the strongest weapon of cornering a downstream nation. Environment and Ecology Research, 1(3), 85–128. Available at: https://doi.org/10.13189/eer.2013.010301.

Adriansen, H.K. (2004) *What happened to the Iraqi Marsh Arabs and their land? The myth about Garden of Eden and the Noble Savage*. DIIS Working Paper 2004/26. Copenhagen: Danish Institute for International Studies. Available at: https://www.files.ethz.ch/isn/18548/Iraqi_Marsh_Arabs.pdf

Ahram, A. I. (2015). Development, counterinsurgency, and the destruction of the Iraqi marshes. International Journal of Middle East Studies, 47(3), 511–529. Available at: https://doi.org/10.1017/S0020743815000288.

Al-Ansari, N. (2019). Hydro geopolitics of the Tigris and Euphrates. In Y. Mustafa, S. Sadkhan, S. Zebari, and K. Jacksi (Eds.), Recent researches in earth and environmental sciences (pp. 35–70). Springer. Available at: https://doi.org/10.1007/978-3-030-18641-8_4.

Al-Ansari, N., Adamo, N., Sissakian, V., Knutsson, S., and Laue, J. (2021). Mosul Dam: The full story. Journal of Earth Sciences and Geotechnical Engineering, 11(3), 1–38. Available at: https://www.diva-portal.org/smash/get/diva2:1535105/FULLTEXT01.pdf.

Al-Hindi, A., Aker, A., and Al-Delaimy, W. K. (2021). The destruction of Gaza's infrastructure is exacerbating environmental health impacts. Environmental Epidemiology, 6(1), e186. Available at: https://doi.org/10.1097/EE9.0000000000000186.

Al-Hudaib, H., Adamo, N., Bene, K., Ray, R., and Al-Ansari, N. (2025). Application of decision support systems to water management: The case of Iraq. Water. Available at: https://www.mdpi.com/2073-4441/17/12/1748.

Almallah, I., Al-Muqdadi, S. W., and Abdalwahab, N. (2024). The complex system of climate change security and the ripple effect of water–food–socioeconomic nexus. Journal of Infrastructure Policy and Development, 8(6). Available at: https://doi.org/10.24294/jipd.v8i6.3928.

Al-Mezan. (2022). On World Water Day: Al-Mezan highlights Israel's water apartheid and selective control. Available at: https://mezan.org/en/post/32936.

Al-Quraishi, A. M. F., Gaznayee, H. A. A., and Messina, J. P. (2021). Drought severity trend analysis based on the Landsat time-series dataset of 1998–2017 in the Iraqi Kurdistan Region. IOP Conference Series: Earth and Environmental Science, 779, 012083. Available at: https://doi.org/10.1088/1755-1315/779/1/012083.

Amery, H. (2020). Malthus in the Middle East. In Scarcity-induced water conflicts. Oxford University Press. Available at: https://doi.org/10.1093/oso/9780197552636.003.0002.

Amnesty International. (2009). The occupation of water. Available at: https://www.amnesty.org/en/latest/campaigns/2017/11/the-occupation-of-water/.

Amnesty International. (2019). Syria: Damning evidence of war crimes and other violations by Turkish forces and their allies. Available at: https://www.amnesty.org/en/latest/press-release/2019/10/syria-damning-evidence-of-war-crimes-and-other-violations-by-turkish-forces-and-their-allies/.

Amnesty International. (2022). Turkey: Unlawful detention, torture and forced returns in the "NES": Protecting YPG/SDF fighters abused by Turkish forces and their proxies in north-east Syria (MDE23/5007/2022). Available at: https://www.amnesty.org/en/documents/MDE23/5007/2022/en/.

Amnesty International. (2025). Israel's decision to cut off electricity supply to Gaza desalination plant. Available at: https://www.amnesty.org/fr/latest/news/2025/03.

ANERA. (2022). Before the tap runs dry: Responding to Gaza's existential water crisis. Available at: https://www.anera.org/wp-content/uploads/2022/07/Anera-Report-Water-Gaza-Palestine-spreads.pdf.

Arab Center Washington DC. (2023, May 30). Water politics in the Tigris–Euphrates Basin. Available at: https://arabcenterdc.org/resource/water-politics-in-the-tigris-euphrates-basin/.

Ash, K., and Obradovich, N. (2019). Climatic stress, internal migration, and Syrian civil war onset. Journal of Conflict Resolution. Available at: https://www.jstor.org/stable/48597419.

Ashwill, M., Lee, D. R., Verner, D., and Wilby, R. (2013). Increasing resilience to climate change in the agricultural sector of the Middle East: The cases of Jordan and Lebanon. World Bank. Available at: https://documents1.worldbank.org/curated/en/115381468249300050/pdf/Middle-East-Increasing-resilience-to-climate-change-in-the-agricultural-sector-of-the-Middle-East-the-cases-of-Jordan-and-Lebanon.pdf.

Asi, Y. M., Berman, G., Blanchet, K., Daw, M. A., Halasa-Rappel, Y., Naser, I., Fouad, F., and Rawaf, S. (2024). "Nowhere and no one is safe": Spatial analysis of damage to critical civilian infrastructure in the Gaza Strip during the first phase of the Israeli military campaign, 7 October to 22 November 2023. Conflict and Health, 18, Article 23. Available at: https://doi.org/10.1186/s13031-024-00580-2.

Atlantic Council. (2017, January 26). The Euphrates Dam is at risk in the SDF operation to capture it from ISIS. SyriaSource. Available at: https://www.atlanticcouncil.org/blogs/syriasource/the-euphrates-dam-is-at-risk-in-the-sdf-operation-to-capture-it-from-isis/.

Avisse, N., Tilmant, A., Rosenberg, D., and Talozi, S. (2020). Quantitative assessment of contested water uses. Available at: https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=4772&context=cee_facpub.

Ballard Brief. (2021). Water waste and mismanagement in Yemen. Available at: https://ballardbrief.byu.edu/issue-briefs/water-waste-and-mismanagement-in-yemen.

Barnes, J. (2009). Managing the waters of Baʿth country: The politics of water scarcity in Syria. Geopolitics, 14(3), 510–530. Available at: https://doi.org/10.1080/14650040802694117.

BBC. (2012, September 7). Aleppo water supply cut as Syria fighting rages. Available at: https://www.bbc.com/news/world-middle-east-19533112.

BBC. (2015, November 24). Yemen conflict: Houthis "blocking Taiz aid deliveries". Available at: https://www.bbc.com/news/world-middle-east-34920858.

BBC. (2017, March 13). Syria conflict: Jets deliberately bombed Damascus spring. Available at: https://www.bbc.com/news/world-middle-east-39266213.

BBC News. (2014, August 19). Iraq crisis: Mosul dam retaken from IS. Available at: https://www.bbc.com/news/world-middle-east-28820509.

BBC Verify. (2025). How big is the task of rebuilding Gaza?. Available at: https://www.bbc.com/news/articles/cr5e4ee9r13o.

Bonn, T. L. (2013). On the political sideline? The institutional isolation of donor organizations in Jordanian hydropolitics. Available at: https://www.researchgate.net/publication/269599770_On_the_political_sideline_The_institutional_isolation_of_donor_organizations_in_Jordanian_hydropolitics.

Borgomeo, E., Fawzi, N., Hall, J., Jägerskog, A., Nicol, A., Sadoff, C., Salman, M., Santos, N., and Talhami, M. (2020). Tackling the trickle: Ensuring sustainable water management in the Arab region. Earth's Future. Available at: https://doi.org/10.1029/2020EF001495.

Bourekba, M. (2021). Climate change and violent extremism in North Africa. CASCADES. Available at: https://www.cascades.eu/publication/climate-change-and-violent-extremism-in-north-africa/.

Britchenko, I. (2025). Climate change as a threat multiplier: Assessing its impact on resource scarcity, migration, and political instability. SSRN. Available at: http://dx.doi.org/10.2139/ssrn.5390525.

Bulmer, M. H. (2018). Military use of environmental degradation by Islamic State, 2014–2016. Scientia Militaria, 46(1), 94–122. Available at: https://doi.org/10.5787/46-1-1228.

Buhaug, H., et al. (2018). "Climate variability, food production shocks, and violent conflict in sub Saharan Africa." Political Geography. Available at: https://iopscience.iop.org/article/10.1088/1748-9326/10/12/125015.

B'Tselem. (2014). Undeniable discrimination in the amount of water allocated to Palestinians in the West Bank. Available at: https://www.btselem.org/press_releases/20140212_discrimination_in_water_allocation.

Cascades. (2021). Climate change, water and future cooperation and development in the Euphrates–Tigris basin (Project report). Available at: https://www.cascades.eu/wp-content/uploads/2021/11/Euphrates-Tigris-Report_Final.pdf.

Cascão, A. E., and Zeitoun, M. (2010). Power, hegemony and critical hydropolitics. Available at:

https://hidropolitikakademi.org/uploads/wp/2014/01/Power+Hegemony+and+Critical+Hydropolitics.pdf.

CETIM. (2020). Violations of the right to water in North and East Syria. Centre Europe–Tiers Monde. Available at: https://www.cetim.ch/wp-content/uploads/Violation-right-to-water_N-S-Syria_ENG-1.pdf.

Chenoweth, J., Hadjinicolaou, P., Bruggeman, A., Lelieveld, J., Levin, Z., Lange, M., Xoplaki, E., and Hadjikakou, M. (2011). Impact of climate change on the water resources of the Eastern Mediterranean and Middle East region: Modeled 21st century changes and implications. Available at: https://www.researchgate.net/publication/225028364_Impact_of_climate_change_on_the_water_resources_of_the_eastern_Mediterranean_and_Middle_East_region_Modeled_21st_century_changes_and_implications.

Chen, Y. *et al.* (2012) 'Socio-economic Impacts on flooding: A 4000-Year history of the Yellow River, China,' *AMBIO*, 41(7), pp. 682–698. https://doi.org/10.1007/s13280-012-0290-5.

Chiragov, F. (2025). The weaponization of water: Environmental policy as a tool of Russian hybrid warfare in the Caspian Sea. Modeling Control and Information Technologies. Available at: https://doi.org/10.31713/MCIT.2025.001.

Choi, Y.-W., and Eltahir, E. (2022). Uncertainty in future projections of precipitation decline over Mesopotamia. Journal of Climate. Available at: https://doi.org/10.1175/JCLI-D-22-0268.1.

CIDOB. (2014, September 30). How long will ISIS last economically?. Available at: https://www.cidob.org/en/publications/how-long-will-isis-last-economically.

CNCDH (Commission nationale consultative des droits de l'homme). (2024). Gaza: Starvation as a weapon of war is strictly prohibited under international law. Available at: https://www.cncdh.fr/sites/default/files/2024-07.

Corry, O. (2017). The international politics of geoengineering: The feasibility of Plan B for tackling climate change. Security Dialogue, 48(4), 297–315. Available at: https://doi.org/10.1177/0967010617704142.

CSIS (Center for Strategic and International Studies). (2024). The siege of Gaza's water. Available at: https://www.csis.org/analysis/siege-gazas-water.

Cox, E., Pidgeon, N., Spence, E., and Thomas, G. (2018). Blurred lines: The ethics and policy of greenhouse gas removal at scale. Frontiers in Environmental Science. Available at: https://doi.org/10.3389/fenvs.2018.00038.

Collier, D. (2011). Understanding process tracing. PS: Political Science and Politics, 44(4), 823–830.

Creswell, J. W. (2009). Research design: Qualitative, quantitative, and mixed methods approaches (3rd ed.). Sage

Damluji, N. (2016). Daesh control of watercourses in Syria and Iraq: Legal analysis. Washington International Law Journal, 25(2), 329–352. Available at: https://digitalcommons.law.uw.edu/cgi/viewcontent.cgi?article=1724&context=wilj.

Daoudy, M. (2009). Asymmetric power: Negotiating water in the Euphrates and Tigris. International Negotiation, 14(2), 361–391. Available at: https://doi.org/10.1163/157180609X432860.

Daoudy, M. (2020). Water weaponization in the Syrian conflict: Strategies of domination and cooperation. International Affairs, 96(5), 1347–1366. Available at: https://doi.org/10.1093/ia/iiaa127.

Daoudy, M. (2021). Rethinking the climate–conflict nexus: A human–environmental–climate security approach. Global Environmental Politics, 21(3), 4–25. Available at: https://ideas.repec.org/a/tpr/glenvp/v21y2021i3p4-25.html.

Dennehy, J. (2026, January 21). Make it rain: UAE issues $1.5m cloud-seeding grants for projects to address water security. The National. Available at: https://www.thenationalnews.com/news/uae/2026/01/21/make-it-rain-uae-issues-15m-cloud-seeding-grants-for-projects-to-address-water-security/.

Derouez, F., and Ifa, A. (2024). Sustainable food security: Balancing desalination, climate change, and population growth in five Arab countries using ARDL and VECM. Sustainability. Available at: https://doi.org/10.3390/su16062302.

Dezfuli, A., Razavi, S., and Zaitchik, B. F. (2022). Compound effects of climate change on future transboundary water issues in the Middle East. Earth's Future, 10(4). Available at: https://doi.org/10.1029/2022EF002683.

Dezfuli, A., and Zaitchik, B. F. (2024). Transboundary sky waters in the Middle East: Definition, challenges, and opportunities. PLOS Water, 3(12), e0000318. Available at: https://doi.org/10.1371/journal.pwat.0000318.

Duarte Lopes, P., and Gama, M. (2025). Reviewing water wars and water weaponisation literatures: Is there an unnoticed link? Water. Available at: https://www.mdpi.com/2073-4441/17/6/897.

Dureab, F., Al-Sakkaf, M., Ismail, O., Kuunibe, N., Krisam, J., Müller, O., and Jahn, A. (2018). Yemen in a time of cholera: Current situation and challenges. The American

Journal of Tropical Medicine and Hygiene, 98(3), 651–656. Available at: https://doi.org/10.4269/ajtmh.17-0811.

Dutch Scholars for Palestine. (2023). The weaponisation of water in Gaza. Available at: https://www.dutchscholarsforpalestine.nl/the-weaponisation-of-water-in-gaza.

EIP (Eyewitness Iraq Project). (2023, August 17). Tabqa. Available at: https://www.eip.org/report-on-the-legacy-of-isis-rule-in-northeast-syria/tabqa/.

Eisenhardt, K. M. (1989). Building theories from case study research. Academy of Management Review, 14(4), 532–550. Available at: https://doi.org/10.5465/amr.1989.4308385.

El-Fadel, M., and Bou-Zeid, E. (2001). Climate change and water resources in the Middle East: Vulnerability, socioeconomic impacts, and adaptation. SSRN. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=278514.

Euro-Med Human Rights Monitor. (2023, August 15). Yemen: Siege of Taiz is collective punishment of civilians, Houthi group must lift it. Available at: https://euromedmonitor.org/en/article/5785.

Fanack Water. (2025). Why Gaza is running out of fresh water. Available at: https://water.fanack.com/why-gaza-is-running-out-of-fresh-water/.

Farrokh, K. (2023) *The campaigns of Sassanian Emperor Shapur I*. https://www.kavehfarrokh.com/news/the-campaigns-of-sassanian-emperor-shapur-i/.

Faour, G., and Fayad, A. (2014). Water environment in the coastal basins of Syria: Assessing the impacts of the war. Environmental Processes. Available at: https://www.researchgate.net/publication/267624681_Water_Environment_in_the_Coastal_Basins_of_Syria_-Assessing_the_Impacts_of_the_War.

Feitelson, E., Tamimi, A., and Rosenthal, G. (2012). Climate change and security in the Israeli–Palestinian context. Available at: https://www.researchgate.net/publication/227574796_Climate_change_and_security_in_the_Israeli-Palestinian_context.

Fragaszy, S., Jedd, T. M., Wall, N., Knutson, C., Fraj, M., Bergaoui, K., Svoboda, M., Hayes, M., and McDonnell, R. (2020). Drought monitoring in the Middle East and North Africa (MENA) region: Participatory engagement to inform early warning systems. Bulletin of the American Meteorological Society. Available at: https://www.researchgate.net/publication/339896933_Drought_Monitoring_in_the_Middle_East_and_North_Africa_MENA_Region_Participatory_Engagement_to_Inform_Early_Warning_Systems.

Galgano, F. A. (2016). Environmental security and trans-boundary water resources. Available at: https://www.researchgate.net/publication/314629661_Environmental_Security_and_Trans-Boundary_Water_Resources.

Geneva Academy. (2020). The Geneva List of Principles on the Protection of Water Infrastructure. Available at: https://www.genevawaterhub.org/resource/geneva-list-principles-protection-water-infrastructure.

Geneva Policy Outlook. (2024). Weaponising water in Gaza. Available at: https://www.genevapolicyoutlook.ch/weaponising-water-in-gaza/.

Geneva Water Hub. (2023). The Geneva List of Principles on the Protection of Water Infrastructure. Available at: https://www.genevawaterhub.org/resource/geneva-list-principles-protection-water-infrastructure.

George, A. L., and Bennett, A. (2005). Case studies and theory development in the social sciences. MIT Press.

Glass, S. (2017). Twisting the tap: Water scarcity and conflict in the Euphrates–Tigris river basin. Available at: https://digitalcollections.sit.edu/cgi/viewcontent.cgi?article=3621&context=isp_collection.

Gleick, P. (2019). Water as a weapon and casualty of armed conflict: A review of recent water-related violence in Iraq, Syria, and Yemen. WIREs Water, 6(4), e1351. Available at: https://doi.org/10.1002/wat2.1351.

Gleick, P., and Shimabuku, M. (2023). Water-related conflicts: Definitions, data, and trends from the Water Conflict Chronology. Environmental Research Letters. Available at: https://iopscience.iop.org/article/10.1088/1748-9326/acbb8f.

Gleick, P. H., Vyshnevskyi, V., and Shevchuk, S. (2023). Rivers and water systems as weapons and casualties of the Russia–Ukraine war. Earth's Future. Available at: https://www.researchgate.net/publication/374260325_Rivers_and_Water_Systems_as_Weapons_and_Casualties_of_the_Russia-Ukraine_War.

Global Voices. (2023, November 20). Iraq, Iran, and local residents continue to oppose Turkey's hydroelectric projects along the Tigris. Available at: https://globalvoices.org/2022/07/19/iraq-iran-and-local-residents-continue-to-oppose-turkeys-hydroelectric-projects-along-the-tigris/.

Grech-Madin, C. (2025). Murky waters of war: Toward a clearer conceptualization of water as a weapon. Environment and Security. Available at: https://doi.org/10.1177/27538796251342138.

Hameed, M., Moradkhani, H., Ahmadalipour, A., Moftakhari, H., Abbaszadeh, P., and Alipour, A. (2019). A review of the 21st century challenges in the food–energy–water security in the Middle East. Water. Available at: https://www.mdpi.com/2073-4441/11/4/682.

Hayat, S., Gupta, J., Vegelin, C., and Jamali, H. (2022). A review of hydro-hegemony and transboundary water governance. Water Policy, 24(11), 1723–1740. Available at: https://doi.org/10.2166/wp.2022.256.

Hejazi, M., Santos da Silva, S. R., Miralles-Wilhelm, F., Kim, S. H., Kyle, P., Liu, Y., Vernon, C., Delgado, A., Edmonds, J., and Clarke, L. (2023). Impacts of water scarcity on agricultural production and electricity generation in the Middle East and North Africa. Frontiers in Environmental Science. Available at: https://doi.org/10.3389/fenvs.2023.1082930.

Herndon, J. M., and Whiteside, M. (2020). Global environmental warfare. Advances in Social Sciences Research Journal, 7(4), 411–422. Available at: https://doi.org/10.14738/assrj.74.8173.

Hevdesti. (2023). Joint statement on the water crisis in northeast Syria. Available at: https://hevdesti.org/en/joint-statement-on-the-water-crisis-in-northeast-syria/.

Hevdesti. (2023, September 6). Weaponizing water during conflict in Syria. Available at: https://hevdesti.org/en/weaponizing-water-during-conflict-in-syria/.

Hoffmann, S. (2021). Review of The origins of the Syrian conflicts, by M. Daoudy. Bustan: The Middle East Book Review, 12(2), 181–186. Available at: https://tau.userservices.exlibrisgroup.com/discovery/fulldisplay?vid=972TAU_INST:AlmaGeneralView&docid=alma9933390167004146&context=L.

Houdret, A. (2008). Les conflits autour de l'eau au Maroc : origines sociopolitiques et écologiques et possibilités d'une transformation des conflits [Doctoral dissertation, Université Paris 8 and Universität Duisburg-Essen]. Available at: https://theses.fr/2008PA083044.

HPA Center. (2024, December 19). Who controls Syria's dams on the Euphrates River: An overview. Available at: https://www.hpacenter.org/tr/article/1944/who_controls_syria%E2%80%99s_dams_on_the_euphrates_river:_an_overview.

Human Rights Watch. (2021, July 22). Iran: Deadly response to water protests. Available at: https://www.hrw.org/news/2021/07/22/iran-deadly-response-water-protests.

Human Rights Watch. (2024, January 19). Houthis blockade Taizz while attacking ships in response to Israel siege of Gaza. Available at: https://www.hrw.org/news/2024/01/19/houthis-blockade-taizz-while-attacking-ships-response-israel-siege-gaza.

Human Rights Watch. (2024, December 19). Extermination and acts of genocide: Israel deliberately depriving Palestinians in Gaza of water. Available at: https://www.hrw.org/report/2024/12/19/extermination-and-acts-genocide/israel-deliberately-depriving-palestinians-gaza.

Human Rights Watch. (2025, February 13). Gaza's water infrastructure desperately needs to be rebuilt. Available at: https://www.hrw.org/news/2025/02/13/gazas-water-infrastructure-desperately-needs-be-rebuilt.

Ide, T., Brzoska, M., Donges, J. F., and Schleussner, C.-F. (2020). Multi-method evidence for when and how climate-related disasters contribute to armed conflict risk. Global Environmental Change, 62, 102063. Available at: https://doi.org/10.1016/j.gloenvcha.2020.102063.

Ide, T., Schleussner, C.-F., Donges, J. F., and Scheffran, J. (2018). The Syria drought as a climate conflict amplifier. Global Environmental Change, 50, 285–294. Available at: https://www.semanticscholar.org/paper/Climate-War-in-the-Middle-East-Drought%2C-the-Syrian-Ide/d80654d515d7f42f20f897893c809e782ce366a1.

International Medical Corps. (2023). Crisis in Yemen. Available at: https://internationalmedicalcorps.org/emergency-response/yemen-conflict-hunger/.

İRAM Center. (2022, February 22). Overview of the water crisis in Khuzestan. Available at: https://iramcenter.org/en/overview-of-the-water-crisis-in-khuzestan_en-705.

IranWire. (2022, July 24). A year on from the 2021 water protests, has anything changed in Khuzestan?. Available at: https://iranwire.com/en/provinces/106012.

Iraq: Water crisis in Basra. (2020, October 28). Human Rights Watch. Available at: https://www.hrw.org/news/2019/07/22/iraq-water-crisis-basra.

Jägerskog, A. (2009). New threats? Risk and securitisation theory on climate and water. In H. G. Brauch, U. Oswald Spring, C. Mesjasz, J. Grin, P. Kameri-Mbote, B. Chourou, P. Dunay, and J. Birkmann (Eds.), Coping with global environmental change, disasters and security: Threats, challenges, vulnerabilities and risks (Hexagon Series on Human and Environmental Security and Peace, Vol. 5). Springer. Available at:

https://www.researchgate.net/publication/281108558_Jagerskog_A_2009_New_threats_Risk_and_Securitisation_theory_on_climate_and_water_in_Brauch_Hans_Gunter_Oswald_Spring_Ursula_Mesjasz_Czeslaw_Grin_John_Kameri-Mbote_Patricia_Chourou_Bechir_Birkmann_Jorn.

Jones, T. (2010). Desert kingdom: How oil and water forged modern Saudi Arabia. Available at: https://www.researchgate.net/publication/259906641_Desert_Kingdom_How_Oil_and_Water_Forged_Modern_Saudi_Arabia.

Kehl, J. R. (2011). Hydropolitical complexes and asymmetrical power: Conflict, cooperation, and governance of international river systems. Journal of World-Systems Research, 17(1), 218–235. Available at: https://doi.org/10.5195/jwsr.2011.429.

Kelley, C., Mohtadi, S., Cane, M., Seager, R., and Kushnir, Y. (2015). Climate change in the Fertile Crescent and implications of the recent Syrian drought. Proceedings of the National Academy of Sciences of the United States of America. Available at: https://doi.org/10.1073/pnas.1421533112.

Kempf, M. (2024). A dataset to model Levantine landcover and land-use change connected to climate change, the Arab Spring and COVID-19. Data in Brief. Available at: https://doi.org/10.1016/j.dib.2024.110198.

Khosravi, M., Mojtabaeian, S. M., and Aghamaleki Sarvestani, M. (2024). A systematic review on the outcomes of climate change in the Middle-Eastern countries: The catastrophes of Yemen and Syria. Environmental Health Insights. Available at: https://doi.org/10.1177/11786302241302270.

Kibaroglu, A., and Sayan, R. C. (2021). Water and “imperfect peace” in the Euphrates–Tigris river basin. International Affairs. Available at: https://www.semanticscholar.org/paper/Water-and-%E2%80%98imperfect-peace%E2%80%99-in-the-Euphrates%E2%80%93Tigris-Kibaroglu-Sayan/df20dbf228053764a788c9c080e22fb24fc76d23.

King, M. D. (2023). Water weaponization: Its forms, its use in the Russia–Ukraine war, and what to do about it. Center for Climate and Security. Available at: https://climateandsecurity.org/2023/06/water-weaponization-its-forms-its-use-in-the-russia-ukraine-war-and-what-to-do-about-it/.

Komurcu, M., Schlosser, C., Alshehri, I., Alshahrani, T., Alhayaza, W., Alsaati, A., and Strzepek, K. (2020). Mid-century changes in the mean and extreme climate in the

Kingdom of Saudi Arabia and implications for water harvesting and climate adaptation. Atmosphere. Available at: https://www.mdpi.com/2073-4433/11/10/1068.

Krzymowski, A. (2021). Water as a weapon of war in the Tigris–Euphrates Basin. Journal of Environmental Studies, 30(2), 45–62. Available at: https://zuscholars.zu.ac.ae/cgi/viewcontent.cgi?article=5873&context=works.

Lambert, L. A. (2014). Water, state power, and tribal politics in the GCC: The case of Kuwait and Abu Dhabi. SSRN. Available at: http://dx.doi.org/10.2139/ssrn.2825913.

Lambert, L. A., and Rioux, J.-S. (2014). The political economy of water: A market contestation approach. Geoforum, 57, 37–45. Available at: https://www.researchgate.net/publication/318010004_Political_Economy_of_Water_Markets_in_the_Western_United_States.

Lancet, The. (2025, June 6). Starvation as a weapon of war in Gaza: Violations of international humanitarian law. The Lancet, 406(10414). Available at: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(25)01018-9/fulltext.

Lange, M. (2019). Impacts of climate change on the Eastern Mediterranean and the Middle East and North Africa region and the water–energy nexus. Atmosphere. Available at: https://www.mdpi.com/2073-4433/10/8/455.

Lessler, J., Moore, S. M., Luquero, F. J., McKay, H. S., Grais, R., Henkens, M., and Azman, A. S. (2018). Mapping the burden of cholera in sub-Saharan Africa and implications for control: An analysis of data across geographical scales. The Lancet, 391(10133), 1908–1915. Available at: https://doi.org/10.1016/S0140-6736(17)33050-7.

Lin, A. C. (2016). The missing pieces of geoengineering research governance. Minnesota Law Review, 100, 2509–2576. Available at: https://www.minnesotalawreview.org/wp-content/uploads/2016/08/Lin_Online.pdf.

Linke, A., and Ruether, B. (2021). Weather, wheat, and war: Security implications of climate variability for conflict in Syria. Available at: https://cnxus.org/wp-content/uploads/2022/11/Linke-and-Ruether-2021-Weather-wheat-and-war_Security-implications-of-climate-variability-for-conflict-in-Syria.pdf.

Luan, W., Li, X., Kuang, W., Su, J., Xue, H., Zhang, K., Zhu, J., and Li, G. (2025). Quantitative assessment of the water stress in the Tigris–Euphrates river basin driven by anthropogenic impacts. Remote Sensing. Available at: https://www.mdpi.com/2072-4292/17/4/662.

Maan Center. (2025, July 11). Thirst and geopolitics. Available at: https://aljumhuriya.net/en/2025/07/11/thirst-and-geopolitics/.

Madani, K. (2014). Water management in Iran: What is causing the looming crisis? Journal of Environmental Studies and Sciences, 4(4), 315–328. Available at: https://www.researchgate.net/publication/264936452_Water_management_in_Iran_What_is_causing_the_looming_crisis.

Mach, K. J., et al. (2019). “Climate as a risk factor for armed conflict.” Nature. Available at: https://www.nature.com/articles/s41586-019-1300-6.

Mason, M. (2022). Infrastructure under pressure: Water management and state-making in southern Iraq. Geoforum. Available at: https://doi.org/10.1016/j.geoforum.2022.04.006.

McLaren, D. P., and Corry, O. (2021). The politics and governance of research into solar geoengineering. WIREs Climate Change. Available at: https://wires.onlinelibrary.wiley.com/doi/10.1002/wcc.707.

Meijer, L. (2018). The Southeastern Anatolia Project (GAP): Water and land resource development in Turkey and its consequences for the Kurdish question (Working paper). Sciences Po Kuwait Program. Available at: https://www.sciencespo.fr/kuwait-program/wp-content/uploads/2018/11/Laura-Meijer-Southeastern-Anatolia-Project.pdf.

Middle East Green Initiative. (n.d.). About MGI. Available at: https://www.sgi.gov.sa/about-mgi/?csrt=87497883996458539.

Middle East Institute. (2025, November 20). Looking to the skies: The growing interest in cloud seeding technology in the Gulf - Middle East Institute. Available at: https://mei.edu/publication/looking-skies-growing-interest-cloud-seeding-technology-gulf/.

Morrissette, J. J., and Borer, D. A. (2004). Where oil and water do mix: Environmental scarcity and future conflict in the Middle East and North Africa. Available at: https://doi.org/10.55540/0031-1723.2223.

Mourad, K. A., Oele, J., Yacoob, W., Greenwalt, J., Zain, M., Al-Okaishi, A., Aulaiah, A., and Berndtsson, R. (2025). Hydrological assessment under climatic and socioeconomic scenarios using remote sensing, QGIS, and climate models: A case study of the Tuban Delta, Yemen. Sustainability. Available at: https://www.mdpi.com/2071-1050/17/5/2258.

Mwatana Organization for Human Rights. (2015, October 15). Siege lands a fatal blow to remaining life in Taiz. Available at: https://www.mwatana.org/posts-en/taiz-siege.

Muralidharan, P., et al. (2024). Weaponization of climate and environment crises: Risks, realities, and consequences. Environmental Science and Policy, 144, 1–12. Available at: https://doi.org/10.1016/j.envsci.2024.103123.

Namdar, R., Karami, E., and Keshavarz, M. (2021). Climate change and vulnerability: The case of MENA countries. ISPRS International Journal of Geo-Information. Available at: https://www.mdpi.com/2220-9964/10/11/794.

Nasef, A. (2025). Climate change and health: Enhancing resilience in fragile systems. Journal of the Best Available Evidence in Medicine, 1(2), 10–14. Available at: https://doi.org/10.63720/v1i2008.

NCRI (National Council of Resistance of Iran). (2023, March 3). How IRGC created and amplifies Iran's water crisis. Available at: https://www.ncr-iran.org/en/news/how-irgc-created-and-amplifies-irans-water-crisis/.

Nightingale, P., and Cairns, R. (2014). The security implications of geoengineering: Blame, imposed agreement and the security of critical infrastructure. Available at: https://www.semanticscholar.org/paper/The-Security-Implications-of-Geoengineering:-Blame,-Nightingale-Cairns/74c82f81af6afc0afbdb59206a19d0255726aa1c.

North Press Agency. (2021, September 10). Water crisis in Syria's Hasakah continues in light of Alouk station shutoff. Available at: https://npasyria.com/en/64642/.

North Press Agency. (2023). Turkey cuts off water from Syria's Hasakah more than 40 times. Available at: https://npasyria.com/en/100410/.

North Press Agency. (2025, April 14). Northeast Syrians face prolonged water crisis as political talks raise hopes for Alouk station restart. Available at: https://npasyria.com/en/124490/.

OCHA (United Nations Office for the Coordination of Humanitarian Affairs). (2021). Syria: Alouk Water Station – Flash update: Disruption to Alouk Water Station. Available at: https://reliefweb.int/report/syrian-arab-republic/syria-alouk-water-station-flash-update-disruption-alouk-water-station.

OHCHR (Office of the United Nations High Commissioner for Human Rights). (2023). The right to water and sanitation in Syria (Advisory note). Available at: https://reliefweb.int/report/syrian-arab-republic/ohchr-advisory-note-right-water-and-sanitation-syria-december-2023-enar.

Olcay, V., and Veret, D. (2022). Euphrates–Tigris drought case study. PreventionWeb. Available at: https://www.preventionweb.net/files/78467_cs9.olcaynveretdroughtcasestudy18ma.pdf.

ORSAM. (2025). ISIS using water resources as a weapon. Available at: https://orsam.org.tr/en/yayinlar/isis-using-water-resources-as-a-weapon/.

Oxfam. (2016, September 28). 1.5 million people have been without running water in Aleppo for five days. Available at: https://www.oxfamamerica.org/explore/stories/million-people-have-been-without-running-water-in-aleppo-for-five-days/.

Oxfam. (2024). Israel using water as weapon of war as Gaza supply plummets by 94 percent. Available at: https://www.oxfam.org/en/press-releases/israel-using-water-weapon-war-gaza-supply-plummets-94-creating-deadly-health.

Oxfam. (2024). Water war crimes: How Israel has weaponised water in its military campaign in Gaza. Available at: https://policy-practice.oxfam.org/resources/water-war-crimes-how-israel-has-weaponised-water-in-its-military-campaign-in-ga-6216.

Oxfam. (2026, January 13). 100 days into ceasefire, Gaza still deliberately deprived of water as aid groups forced to scavenge for supplies. Oxfam International. Available at: https://www.oxfam.org/en/press-releases/100-days-ceasefire-gaza-still-deliberately-deprived-water-aid-groups-forced-scavenge.

Palestine Australia. (2016). Water inequality under Oslo II. Available at: https://www.palestine-australia.com/assets/Uploads/Water-Inequality-Under-Oslo-21102016.pdf.

Passeri, A. (2022). Authoritarian rule and the weaponisation of natural disasters: The case of Myanmar from Cyclone Nargis to the COVID-19 pandemic (2008–2021). Journal of Asian Security and International Affairs. Available at: https://journals.sagepub.com/doi/abs/10.1177/23477970221098475.

PAX. (2018). Weaponizing drinking water (Case 12). In On civilian harm: 20 case studies on civilian suffering in armed conflict. PAX Protection of Civilians. Available at: https://protectionofcivilians.org/wp-content/uploads/reports/PAX_POC_BOOK_CASE12_SINGLE_PAGES_FINAL-1.pdf.

PAX. (2020). Case 12: Weaponizing drinking water: The use of water as a weapon in the conflict in Syria. Available at: https://protectionofcivilians.org/report/case-12-weaponizing-drinking-water/.

PAX for Peace. (2020, December 6). Water access to north east Syria cut off by Türkiye-backed armed groups. Available at: https://paxforpeace.nl/news/water-access-to-north-east-syria-cut-off-by-turkey-backed-armed-groups/.

PAX. (2022). “We fear more war. We fear more drought.”: How climate and conflict are fragmenting rural Syria. Available at: https://paxforpeace.nl/wp-content/uploads/sites/2/import/2022-02/PAX_report-Pastoralist_Syria.pdf.

Popik, T. S. (2022). Preserving Ukraine's electric grid during the Russian invasion. Journal of Critical Infrastructure Policy, 3(1), 15–55.

PreventionWeb. (2026, January 26). Iran: Environmental crises now threaten the regime's survival. Available at: https://www.preventionweb.net/news/irans-regime-has-survived-war-sanctions-and-uprising-environmental-crises-may-bring-it-down.

Qadri, F., Islam, T., and Clemens, J. D. (2018). Cholera in Yemen—An old foe rearing its ugly head. The New England Journal of Medicine, 377(21), 2005–2007. Available at: https://doi.org/10.1056/NEJMp1712099.

Radwan, R. (2022, June 13). How artificial rain can make a difference to Saudi Arabia and Gulf region's water situation. Arab News. Available at: https://www.arabnews.com/node/2091101/middle-east.

Rajsekhar, D., and Gorelick, S. (2017). Increasing drought in Jordan: Climate change and cascading Syrian land-use impacts on reducing transboundary flow. Science Advances. Available at: https://www.science.org/doi/10.1126/sciadv.1700581.

Reininghaus, F., Krüger, M., and Giese, E. (2019). Water contamination as terrorism: Distinguishing intentional from unintentional acts. Security Studies, 28(4), 567–589.

Rezaei, A., Karami, K., Tilmes, S., and Moore, J. C. (2024). Future water storage changes over the Mediterranean, Middle East, and North Africa in response to global warming and stratospheric aerosol intervention. Earth System Dynamics. Available at: https://esd.copernicus.org/articles/15/91/2024/.

Rubin, A. J., and Denton, B. (2023, June 22). Cloud Wars: Mideast rivalries rise along a new front. The New York Times. Available at: https://www.nytimes.com/2022/08/28/world/middleeast/cloud-seeding-mideast-water-emirates.html.

Rougé, C., Tilmant, A., Zaitchik, B., Dezfuli, A., and Salman, M. (2018). Identifying key water resource vulnerabilities in data-scarce transboundary river basins. Water Resources Research. Available at: https://doi.org/10.1029/2017WR021489.

Sahour, H., Vazifehdan, M., and Alshehri, F. (2020). Aridity trend in the Middle East and the adjacent areas. Available at: https://www.researchgate.net/publication/340006478_Aridity_Trend_in_the_Middle_East_and_the_Adjacent_Areas.

Sakal, H. (2022). The risks of hydro-hegemony: Turkey's environmental policies and shared water resources in the South Caucasus. Caucasus Survey. Available at: https://www.semanticscholar.org/paper/The-Risks-of-Hydro-Hegemony%3A-

Turkey%E2%80%99s-Environmental-Sakal/0cda46a4bad882c93b5115067884bcb8e60ce9ca.

Salem, A., Al-Jaadi, A., Mohammed, A., Al-Shami, A., and Al-Matari, E. (2025). Healthcare accessibility in Yemen's conflict zones: A comprehensive review of challenges, impacts, and international efforts. Medicine, 104(2), e40729. Available at: https://doi.org/10.1097/MD.0000000000040729.

Schillinger, J., Özerol, G., Güven-Griemert, Ş., and Heldeweg, M. (2020). Water in war: Understanding the impacts of armed conflict on water resources and their management. WIREs Water, 7(2), e1480. Available at: https://doi.org/10.1002/wat2.1480.

Securing Europe. (2015, November 29). ISIS's water wars and the land of two rivers. Available at: https://securing-europe.wp.hum.uu.nl/final-water-wars-isis/.

SIPRI. (2023). Climate, peace and security fact sheet: Yemen 2023. Available at: https://www.sipri.org/sites/default/files/2023-06/2023_sipri-nupi_fact_sheet_yemen_june.pdf.

Solar radiation modification: NOAA State of the Science factsheet. (2024, October 3). NOAA Climate.gov. Available at: https://www.climate.gov/news-features/understanding-climate/solar-radiation-modification-noaa-state-science-factsheet.

Syria Direct. (2017, January 25). Wadi Barada "a disaster area" as civilians driven underground, battle for water spring escalates. Available at: https://syriadirect.org/wadi-barada-a-disaster-area-as-civilians-driven-underground-battle-for-water-spring-escalates/.

Syria Direct. (2020, August 11). Turkish dams threaten northeast Syria with ecological and economic blight. Available at: https://syriadirect.org/turkish-dams-threaten-northeast-syria-with-ecological-and-economic-blight/.

Syria Direct. (2023, October 25). Hasakah residents ration as "water war" persists. Available at: https://syriadirect.org/hasakah-residents-ration-as-water-war-persists/.

Syrians for Truth and Justice. (2020, April 1). 49 Syrian organizations condemn Turkey's intentional interruption of water in northeastern Syria. Available at: https://stj-sy.org/en/49-syrian-organizations-condemn-turkeys-intentional-interruption-of-water-in-northeastern-syria/.

Syrians for Truth and Justice. (2021, July 15). Timeline of the disruptions series of Aluk Water Pumping Station, north-east Syria. Available at: https://stj-sy.org/en/timeline-of-the-disruptions-series-of-aluk-water-pumping-station-north-east-syria/.

Syrians for Truth and Justice. (2023, September 13). 110 Syrian organizations condemn the deprivation of civilians in northeast Syria of their right to access water. Available at:

https://stj-sy.org/en/110-syrian-organizations-condemn-the-deprivation-of-civilians-in-northeast-syria-of-their-right-to-access-water/.

Tabari, H., and Willems, P. (2018). More prolonged droughts by the end of the century in the Middle East. Environmental Research Letters. Available at: https://doi.org/10.1088/1748-9326/aae09c.

Tabor, R., Almhawish, N., Aladhan, I., Tarnas, M., Sullivan, R., Karah, N., Zeitoun, M., Ratnayake, R., and Abbara, A. (2023). Disruption to water supply and waterborne communicable diseases in northeast Syria: A spatiotemporal analysis. Conflict and Health. Available at: https://link.springer.com/article/10.1186/s13031-023-00502-3.

Tignino, M. (2016). Water in armed conflicts. International Institute of Humanitarian Law. Available at: https://iihl.org/mara-tignino-water-in-armed-conflicts/.

Turkish Ministry of Foreign Affairs. (1996). Water: A source of conflict or cooperation in the Middle East. Available at: https://www.mfa.gov.tr/data/DISPOLITIKA/WaterASourceofConflictofCoopintheMiddleEast.pdf.

UNEP. (2024). The climate technology progress report 2024. United Nations Environment Programme. Available at: https://unepccc.org/wp-content/uploads/2024/12/the-climate-technology-progress-report-2024.pdf.

UNICEF. (2016, September 23). UNICEF Representative in Syria statement on attacks and deliberate water cuts in Aleppo. Available at: https://www.unicef.ie/2016/09/23/syria-unicef-statement-water-cuts/.

UNICEF. (2020, August 1). Drinking water systems under repeated continuous attack in Yemen. Available at: https://www.unicefusa.org/press/drinking-water-systems-under-repeated-continuous-attack-yemen.

UNICEF. (2021). Water under fire: Attacks on water and sanitation services in armed conflicts. Available at: https://www.unicef.org/reports/water-under-fire-volume-3.

UNICEF and WHO (2017, June 24). Statement from UNICEF Executive Director Anthony Lake and WHO Director-General Margaret Chan on the cholera outbreak in Yemen as suspected cases exceed 200,000. World Health Organization. Available at: https://www.who.int/news/item/24-06-2017-statement-from-unicef-executive-director-anthony-lake-and-who-director-general-margaret-chan-on-the-cholera-outbreak-in-yemen-as-suspected-cases-exceed-200-000.

United Nations Security Council (2025) *Water weaponization in armed conflict* (S/2025/453). Available at:. Available at: https://digitallibrary.un.org/record/4085252/files/S_2025_453-EN.pdf.

United States Department of State. (2017, September 26). Helping to restore water infrastructure to Iraqi town liberated from ISIS. ReliefWeb. Available at: https://reliefweb.int/report/iraq/helping-restore-water-infrastructure-iraqi-town-liberated-isis.

Van Steen, J. (2021). How Turkish-Syrian freshwater policy influenced the Syrian Civil War [Master's thesis, Radboud University]. Radboud Repository. Available at: https://theses.ubn.ru.nl/bitstreams/a182a47c-399c-4f01-a72e-b46e4413bb6c/download.

von Lossow, T. (2016). Water as weapon: IS on the Euphrates and Tigris (SWP Comments No. 3). Stiftung Wissenschaft und Politik. Available at: https://www.swp-berlin.org.

von Lossow, T. (2016). The rebirth of water as a weapon: IS in Syria and Iraq. Available at: https://www.tandfonline.com/doi/full/10.1080/03932729.2016.1213063.

von Lossow, T. (2020). Weaponizing water in the Middle East. Available at: https://www.researchgate.net/publication/348651901_Weaponizing_Water_in_the_Middle_East_Lessons_Learned_from_ISLessons_Learned_from_IS.

Warner, J. (2008). Contested hydrohegemony: Hydraulic control and security in Turkey. Water Alternatives, 1(2), 271–288. Available at: https://www.water-alternatives.org/index.php/alldoc/articles/vol1/v1issue2/32-a1-2-6/file.

Watchers News. (2025, May 28). Iraq launches water initiative as reserves hit 80-year low. Available at: https://watchers.news/2025/05/28/iraq-water-reserves-initiative-80-year-low/.

Wehrey, F. (2023). Libya's political economy and energy infrastructure. In F. Wehrey, M. Daher, J. Dargin, K. El-Sharif, S. Haydar, A. Shehabi, and R. Muasher (Eds.), Climate change in the Middle East and North Africa (pp. 43–46). Carnegie Endowment for International Peace. Available at: https://carnegie-production-assets.s3.amazonaws.com/static/files/MEP%20-%20Climate.pdf.

Weiss, M. (2015). A perfect storm: The causes and consequences of severe water scarcity, institutional breakdown and conflict in Yemen. International Journal of Water Resources Development. Available at: https://www.tandfonline.com/doi/abs/10.1080/02508060.2015.1004898.

Wikipedia contributors. (2017). Wadi Barada offensive. In Wikipedia. Available at: https://en.wikipedia.org/wiki/Wadi_Barada_offensive_(2016%E2%80%932017) (Accessed: February 2, 2026).

Wikipedia contributors. (2021). 2021 Iranian water protests. In Wikipedia. Available at: https://en.wikipedia.org/wiki/2021_Iranian_water_protests (Accessed: February 2, 2026).

WHO (World Health Organization). (2024). Yemen. In WHO results report 2024–2025: Region EMRO. Available at: https://www.who.int/about/accountability/results/who-results-report-2024-2025/region-EMRO/2024/yemen.

WHO (World Health Organization). (2024, December 23). Yemen reports the highest burden of cholera globally. WHO EMRO. Available at: https://www.emro.who.int/media/news/yemen-reports-the-highest-burden-of-cholera-globally.html.

World Bank (2018). Beyond water scarcity: Managing water under stress in the Middle East and North Africa. Available at: https://www.worldbank.org/en/topic/water/publication/beyond-scarcity-water-security-in-the-middle-east-and-north-africa.

World Bank and UNEP. (2009). Beyond scarcity: Water security in the Middle East and North Africa. World Bank. Available at: https://openknowledge.worldbank.org/entities/publication/62f75eb4-5488-50dc-9bb5-b54b12a32ac0.

Yin, R. K. (2014). Case study research: Design and methods (5th ed.). Sage.

Zeitoun, M., and Warner, J. (2006). Hydro-hegemony—A framework for analysis of trans-boundary water conflicts. Water Policy, 8(5), 435–460. Available at: https://doi.org/10.2166/wp.2006.054.

Zürn, M., and Schäfer, S. (2013). The paradox of climate engineering. WZB Berlin Social Science Center. Available at: https://www.wzb.eu/system/files/docs/ipl/gg/the_paradox_of_climate_engineering_globa l_policy.pdf.