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Irrigation and Insurgency: Can Public Infrastructure Mitigate Climate-Induced Conflict in Afghanistan?

Pengshan Pan

OSCE Academy in Bishkek

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Abstract

This study examines the role of public irrigation infrastructure in mitigating climate-induced conflicts in Afghanistan, with a focus on individual engagement with armed groups. Through the analysis of Armed Conflict Location and Event Data Project (ACLED) data from 2017 to 2021, as well as Afghan Household Surveys from 2014 and 2017, this study emphasizes the differentiated effectiveness of various irrigation systems in addressing water-related conflicts. Large-scale, externally aided irrigation projects, such as river dams and canals, may be inadequate in dissuading individuals from participating in armed conflict. In contrast, locally driven, community-based irrigation practices, exemplified by kariz systems, demonstrate promise in alleviating climate-related stressors and reducing the intensity of conflicts.

Keywords: infrastructure, climate-induced conflict, Afghanistan, irrigation systems, kariz systems, community-based approaches

JEL Codes: Q25, Q54, H54, O13, O53

Pengshan Pan is a PhD Candidate, Graduate School of Public and International Affairs, University of Pittsburgh, Pittsburgh, PA, USA

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Introduction

Afghanistan has faced ongoing conflict for decades, a situation that has been further exacerbated by water scarcity in the arid country. With a predominantly rural population, the nation relies heavily on irrigation for agricultural production, making access to water resources a critical issue. The increasing demand for water, driven by a changing climate, has intensified tensions among various factions, particularly local communities competing for limited water access. This heightened competition over water resources has not only intensified existing conflicts but also driven more people to join insurgent groups, further destabilizing the region. As a result, addressing water scarcity in Afghanistan is crucial in order to mitigate conflicts.

This paper questions the role of water infrastructure aid in mitigating conflict in Afghanistan. While recognizing that some water infrastructure projects may yield positive results, the paper emphasizes the need for careful consideration and evaluation of water infrastructure development. Irrigation and water infrastructure have long been crucial to the region as it relies heavily on water availability for agriculture. Additionally, irrigation systems play a vital role in ensuring access to potable water for drinking, hygiene, and sanitation, making disruptions to water supply a significant factor in local politics. Traditional community-managed irrigation systems such as kariz (also known as karez, qanat, ka¯r¯ız, and other variations depending on the region or language) are prevalent in Afghanistan. However, recent decades have seen a shift to large-scale, government-managed systems supported by international irrigation aid, which aim to address the water scarcity issue by improving water infrastructure. This transformation has inadvertently heightened competition over water resources and incited conflicts among disparate groups, undermining the potential benefits of some international water infrastructure aid projects in conflict mitigation (World Bank, 2023). Consequently, to ensure that water infrastructure development does not inadvertently exacerbate conflicts in Afghanistan and to promote peace and stability, careful evaluation of water infrastructure aid is needed.

The National Water Affairs Regulation Authority (NWARA) oversees the management of Afghanistan's water resources, receiving assistance from international organizations such as the UNDP, UNOPS, and FAO on a variety of water projects. For instance, the Irrigation Restoration and Development Project (IRDP) and numerous NGOs have focused on improving water supply and sanitation, particularly in rural areas, as a means to prevent conflict. However, it has been observed that, under such projects, Community Development Councils (CDCs) and Provincial Rural Rehabilitation and Development (PRRD) units often lack the necessary technical capacity, thereby affecting the quality and maintenance of water infrastructure. Given that Afghanistan continues to face the impacts of climate change and ongoing conflict, a comprehensive understanding of these challenges, as well as the effectiveness of water infrastructure development efforts in preventing conflict, is crucial for fostering peace, stability, and sustainable water management in the country.

This article examines the varying role of foreign-aided or state-funded irrigation dams compared to traditional kariz irrigation systems in reducing water-related conflicts in Afghanistan. By examining the actors involved in conflicts, the study underscores the importance of developing equitable and sustainable water resource management strategies to ease tensions and encourage cooperation among local inhabitants. A key finding of this study is that large-scale, externally supported infrastructure projects, such as river dams, may be insufficient in discouraging individuals from participating in

armed conflict. Conversely, locally driven, community-based irrigation practices, exemplified by kariz systems, show promise in alleviating climate-related stressors and reducing conflict intensity. This relationship can be attributed to the role these systems play in maintaining social cohesion and fostering community ties which contribute to overall stability in the area. Empirical statistics from the Household Survey reveal that individuals who experience water-related disasters are more likely to join armed groups if they live near dams but are less likely to do so if they live near kariz systems. Moreover, the Armed Conflict Location & Event Data Project data indicates that the building of water dams is more likely to be related to conflict downstream.

Top-down water infrastructure aid programs like dams can inadvertently exacerbate tensions or create new conflicts due to perceived inequity in resource distribution. On the other hand, kariz systems, which involve community-led management of water resources, promote fairness, and reduce the likelihood of resource-driven conflicts. Based upon an analysis of Armed Conflict Location and Event Data Project (ACLED) data from 2017 to 2021 (Raleigh et al., 2010), along with household surveys from 2014 and 2017 (CSO, 2018), and employing propensity score matching, this study provides empirical evidence on the efficacy of infrastructure in conflict prevention, particularly emphasizing the advantages of community-led over top-down systems. The study finds that rivers with dams and aid-driven irrigation projects experience more conflict than those without such interventions. It underscores how community-managed water systems, managed by local irrigation users and community elders, are more effective in reducing conflict as compared to top-down approaches. Specifically, deep well pumps, snowmelt, kariz, and spring water systems prove more beneficial than projects near rivers, canals, and dams, which may escalate conflicts. The kariz system's collaborative model of water resource management aligns with the principles of thorough community consultation and respect for customary practices emphasized in the state-building and customary governance literature.

This study contains multiple sections. It presents the literature on climate change, water management, and conflict in Afghanistan. This is followed by an examination of the country's severe environmental challenges, with a comparison between dam and kariz irrigation systems. The paper then applies Ostrom's theoretical framework to illustrate why top-down systems can affect conflict. Subsequently, it discusses the case of the AF Irrigation Restoration and Development Project and its inadvertent role in intensifying violence. Lastly, it covers the regression analysis and propensity score matching used to respectively highlight the correlation between weather shocks and individuals' likelihood of participating in conflicts, and the differential impacts of irrigation systems on conflict resolution.

Literature Review

Climate Change and Conflict: Extant research investigates the complex relationship between climate change, extreme weather events, unemployment, and conflict, suggesting that these factors collectively render individuals more susceptible to joining armed groups. Afghanistan faces substantial climate change and natural disaster impacts, resulting in frequent losses of life and property. Numerous studies have established that deviations from moderate temperature and rainfall patterns systematically elevate conflict risk (Burke et al., 2015; Couttenier and Soubeyran, 2014; Crost et al., 2014, 2018; Fisher et al., 2012; Jia, 2014; Miguel and Satyanath, 2011; Miguel et al., 2004). Resultant climate hazards, such

as droughts and floods, not only lead to short-term property losses and livelihood disruptions but also cause long-term consequences for agricultural output. Research contends that drought incentivizes pastoralists to plunder farmers before harvest (McGuirk and Nunn, 2020), while insurgent groups in Iraq and Afghanistan are more likely to comprise propertyless farmers (Berman et al., 2011a). Food scarcity or unemployment can also propel farmers into conflict (Angrist and Kugler, 2008). The Afghan household survey data corroborate these findings, revealing that individuals experiencing climate shocks, including extreme weather and natural disasters, are more likely to participate in conflict.

Water Management and Conflict: Petersen-Perlman et al. (2017), Schillinger et al. (2020), and Wolf (2007) provide an extensive understanding of global water-related conflicts. They advocate for a comprehensive approach to water management, taking into account factors such as politics, climate, technology, and tradition. These authors also stress the importance of water provision and the role of international aid. Their studies have shed light on triggers for conflict over water sharing, the importance of local communities, and the potential costs of non-cooperation.

They conclude that power asymmetries exist between riparian states, and that transboundary water issues can cause tensions, but also present opportunities for dialogue and collaboration. They found that successful agreements often transition from a focus on rights to an emphasis on needs and interests, leading to an equitable distribution of benefits. They also note that the threat of a gradual decrease in water quality or quantity can affect a nation's internal stability and exacerbate tensions between groups or states, potentially influencing international dynamics.

Wolf (2007) discusses the transformation of water management from conflict to cooperation, with strategies grounded in principles of shared governance, joint management, and adherence to international and customary law. Wolf underscores the significance of recognizing mutual benefits and employing mediators to ensure the peaceful resolution of water-related disputes. His emphasis on inclusive stakeholder participation illuminates the potential for cooperation not only at the governmental level but also among local communities, non-governmental organizations, and other entities with vested interests in water resources.

Afghanistan's enduring instability is deeply intertwined with water scarcity, which is exacerbated by poor governance of water access and management. Goes et al. (2016) demonstrated the role of political tensions and infrastructural challenges in managing the shared Helmand River Basin, calling for stronger transboundary cooperation. Mianabadi et al. (2020) used remote sensing data to elucidate the Iran-Afghanistan water dispute, attributing issues of downstream water availability to governance. Shokory et al. (2023) highlighted the implications of climate change on water resources. Mahaqi (2021) explored traditional water management systems, underscoring their potential utility in future strategies.

Water access deficiencies extend beyond agriculture. Insufficient water accessibility contributes to significant sanitation and health issues in Afghanistan (Climate Diplomacy, 2023). Numerous projects have been implemented to improve the conditions of water infrastructure. For instance, US irrigation management experts have conducted workshops on efficient irrigation management in high-altitude, water-rich areas for their Afghan counterparts. However, both formal and customary institutions continue to struggle with these water-related problems, further eroding trust in the state

and traditional resource management. Urban water management is typically overseen by water boards and municipalities, whereas rural regions often rely on customary authorities such as Mirabs. These traditional figures administer water distribution, maintain local water infrastructure, and manage disputes. The sporadic implementation of formal water management, coupled with government officials' limited understanding of traditional systems, results in confusion over roles and responsibilities between formal and informal water management institutions, thereby undermining both systems. The Taliban have exploited local informal water management systems, known as Mirabs, which have been utilized for centuries to peacefully distribute often limited water supplies among farmers. Through force, they have redirected water resources towards poppy cultivation, leading to a decrease in food crop production and disruption of the Mirab system. This, coupled with drought, has left farmers with few choices in what to grow, leading to increased food insecurity and pushing them towards illicit groups.

Foreign Aid, Infrastructure, and Conflict: Understanding the relationship between infrastructure development, foreign aid, and conflict is pivotal in shaping more effective development policies and interventions. Infrastructure, such as dams, has been linked to agricultural productivity, poverty, and even conflict, especially in regions marked by ethnic polarization and division (Duflo and Pande, 2007; Eberle, 2020; Strobl and Strobl, 2011). The link between conflict and rainfall is moderated by the presence of irrigation infrastructure (Autesserre, 2014; Gatti et al., 2021). Furthermore, the impacts of other types of infrastructure, including highways and railroads, have been extensively studied Atack et al. (2010); Banerjee et al. (2012); Chandra and Thompson (2000); Dinkelman (2011); Lipscomb et al. (2013); Michaels (2008).

The role of top-down water aid programs, particularly those associated with infrastructure, has been studied extensively. The Community Driven Reconstruction (CDR) initiative, which aims to promote social reconciliation through local institution building, has demonstrated how foreign aid project benefits can be co-opted by existing power brokers (Fearon et al., 2009). Furthermore, as shown by Addison (2001); Anderson (1999); Collier and Dollar (2002); Maren (2009); Sida (2013), providing aid to conflict regions can potentially exacerbate conflict risks. The overarching debate about foreign aid's influence on conflict thus begins with a fundamental question: Does aid genuinely foster development? (Collier and Dollar, 2002; Easterly, 2006; Sachs and Warner, 2001). It seems that an influx of resources should promote economic growth and enhance a country's development trajectory (Sachs, 2006). However, some researchers contend that the displacement and economic disruption induced by infrastructure aid could escalate conflict likelihood by decreasing the opportunity costs of rebellion, while others maintain that these same factors may actually reduce violence (Alesina and Zhuravskaya, 2011; Alesina et al., 2016; Besley and Persson, 2011; Esteban et al., 2012; Fearon, 2005; Montalvo and Reynal-Querol, 2005). Likewise, Berman et al. (2011b) show that aid might not only increase the opportunity cost of recruitment into military organizations, thereby deterring participation, but could also improve security by encouraging the population's interest in sharing information about insurgents.

The literature indicates that the provision of public goods is often more successful in ethnically homogeneous communities due to higher levels of cooperation (Habyarimana et al., 2009). The historical context also plays a critical role in shaping the effectiveness of aid programs, as evidenced by cases in Kazakhstan and Uzbekistan (Amirova et al., 2019). This research adds to the existing literature by highlighting the need for a comprehensive and detailed approach when planning water infrastructure aid projects with the aim of mitigating conflict.

Customary Governance and Conflict: The literature on state-building and customary governance in rural Afghanistan offers diverse perspectives on the role of informal institutions in shaping the political order and state development. Scholars like Murtazashvili (2016), Barfield (2010), and Giustozzi (2011) emphasize the adaptability and resilience of customary organizations, highlighting their crucial role in fostering citizen support for democracy, enabling the rule of law, regulating access to resources, and maintaining social order in the absence of a strong central state. However, some researchers, such as Ruttig (2012) and Mielke (2013), question the harmonious coexistence of customary governance with state-building efforts, pointing to the dominance of strongmen in some areas and the potential for systems like the mirab to primarily serve wealthy and powerful landowners. Despite these concerns, Murtazashvili (2016) posits that the traditional order does not inherently impede state-building, with even the most independent-minded communities acknowledging the need for a central government. She also, however, emphasizes the importance of substantive consultation with communities and respect for existing customary practices when implementing state interventions in local governance. As a result, the effectiveness of infrastructure projects in reducing conflict hinges on understanding and incorporating these diverse perspectives and local customary practices.

Background

Characterized by a continental arid climate with semi-desert levels of precipitation (Swedish Committee for Afghanistan, 2023), Afghanistan frequently experiences droughts, predominantly in its northern, central, and western highlands. Water is a vital resource, with agriculture, which employs 66 percent of the workforce, heavily relying on it (Food and Agriculture Organization of the United Nations, 2023). However, decades of conflict have devastated Afghanistan's crucial water systems. Prior to the Taliban takeover, the Ministry of Energy and Water Resources, supported by international donors, supervised the revitalization of the irrigation system.

Irrigation is primarily sourced from rivers, canals, deep well pumps, Kariz, nawara, , and snowmelt. Top-down systems, bolstered by the central government and international donors, contrast with bottom-up systems like well pumps and Kariz. These community-managed bottom-up systems account for 90 percent of the irrigated area (Rout, 2008).

Kariz systems, which provide access to groundwater, are especially prevalent in the Helmand River Basin provinces, accommodating over 50 percent of all Kariz (Rout, 2008). These systems are pivotal for Afghanistan's irrigation, as the agriculture sector depends heavily on adequate melting of the substantial winter snowfall from the mountainous regions come spring.

Community-Based Irrigation System: Kariz

Water infrastructure, which is fundamental to people's lives, can be governed by the state or by self-governing communities. Kariz systems, or underground water channels, are neither purely public nor private goods. Instead, they are classified as common pool resources, as individuals can be excluded if they do not contribute to their maintenance (Murtazashvili and Murtazashvili, 2021).

Works by Murtazashvili and Murtazashvili (2021) and Rout (2008) shed light on the structure of bottom-up water systems, which are typically managed by a senior community member. In areas such as Herat this individual is known as a wakil, while in regions like Kunduz and Balkh they are referred to as a mirab bashi. Not only do they possess a deep understanding of the system, but they also wield influence over local government. They often receive assistance from a main canal committee or a mirab or chak bashi, representing different sections of the system.

While financial constraints often prevent villages from building irrigation infrastructure, traditional systems, such as the mirab, manage water access effectively. Interventions from donors or the state can enhance water access and, in turn, boost agricultural production. However, such interventions must respect and consider the prevailing local methods of managing irrigation (Murtazashvili and Murtazashvili, 2021).

Mirabs, who often serve multiple communities, manage expansive irrigation systems. They resolve

disputes and ensure efficient water use, even in the face of challenges such as coordination among rural communities. Their role in water governance is crucial and distinct from that of the shuras, who are responsible for collective decision-making.

Water allocation in Afghanistan varies according to the system and location. For instance, the rotational system, or nawbat, allocates water in hours per return interval and is often utilized during periods of low water flow. The Kariz system, on the other hand, supplies water for irrigation, domestic use, and livestock, with allocations based on water rights and rotations similar to the nawbat system.

Traditional water systems in Afghanistan, such as the Kariz with mirab systems, are advantageous due to their simplicity, adaptability, and the local representation they offer. Potential improvements include enhancing control systems, improving structure durability, reducing maintenance costs, and optimizing canal design as well as organizational and water allocation practices.

In the case of outside intervention, it is crucial to recognize and respect the efficacy of existing local water governance systems, such as the mirab system. State and donor investments should not undermine these systems but aim to augment them. Any attempted reform must carefully consider whether it reinforces or erodes local self-governance (Murtazashvili and Murtazashvili, 2021).

Top-down Irrigation System: NWARA

The National Water Affairs Regulation Authority (NWARA), under Afghanistan's Ministry of Energy and Water, regulates, develops, and manages the country's water resources. With the support of international organizations, NWARA implements policies related to water resource management, improves irrigation systems, and enhances agricultural productivity. Notwithstanding these efforts, significant challenges such as security concerns, limited financing, inadequate infrastructure, and governmental capacity constraints persist.

In partnership with international donors, Afghanistan is considering an irrigation management framework called the Irrigation Restoration and Development Project (IRDP), which granted a SDR 61.7 million (US$97.8 million) to Afghanistan. The IRDP, is aimed at repairing irrigation systems damaged by conflict and includes plans for the restoration of irrigation infrastructure, small dam construction, hydrometeorological services establishment, and technical assistance capacity-building (World Bank, 2020).

Community Development Councils (CDCs), part of the National Solidarity Programme, play a significant role in rural water supply and sanitation. As of 2010, there were about 22,000 CDCs involved in 11,700 projects valued at US$157 million related to water supply, sanitation, and flood control (World Bank, 2020). However, these councils often lack technical expertise in water engineering, and support from the Provincial Rural Rehabilitation and Development (PRRD) unit is frequently inadequate. This limitation hampers maintenance and major repair efforts.

An example of the IRDP's efforts is the rehabilitation of the Balkhi Canal, one of over 180 similar projects across the country. These projects have reportedly benefited over 425,000 households and are aimed at enhancing irrigation facilities and strengthening NWARA's water management capacity (World Bank, 2020).

The top-down approach of NWARA has its drawbacks. Limited local engagement, bureaucratic inefficiencies, and dependency on external support are among its shortcomings. Furthermore, the centralized structure may not adequately involve local communities in decision-making processes, leading to a lack of project ownership and understanding at the grassroots level. Consequently, a more community-driven, bottom-up approach involving local communities in decision-making processes and tailoring projects to local needs should be considered for more successful and sustainable outcomes.

Methodological Framework and Data

Theoretical Framework: Common Pool Resource Management

Top-down water infrastructure aid programs like dams could inadvertently intensify existing conflicts or incite new ones due to perceived inequity or resource competition. Alternatively, kariz systems promote equitable resource distribution and community cooperation, reducing the propensity for conflict. By emphasizing community involvement in water management, kariz systems align with literature advocating for consultation and respect for customary practices in state-building. This approach promotes social cohesion and community ties, deterring individuals from joining insurgent groups.

The theoretical underpinning of this paper is Ostrom's work on Common Pool Resources (CPRs) (Ostrom, 1990). CPR management involves harmonizing individual and collective interests and managing differing group sizes. Effective management provides adaptable infrastructure, encourages internal operations, forges external linkages, and facilitates adaptation to new developments.

Ostrom delineates principles for efficient CPR management, such as collective decision-making, accountable rule enforcement, graduated sanctions for violations, accessible conflict resolution mechanisms, recognition of appropriators' autonomy by higher authorities, and multi-tiered organization for larger CPRs.

Adaptive governance is also proposed by Ostrom for CPR management, optimally addressing complex and uncertain issues. Key components of adaptive governance include accurate and timely information for conflict resolution, anticipatory conflict management, user accountability for rule adherence, and adaptability for sustainable governance.

Compared to foreign water infrastructure aid or state-funded irrigation systems, traditional kariz systems effectively manage water-related conflicts by encouraging farmer cooperation. This community-based approach outperforms top-down solutions. Local governance bolsters cooperation and interaction among group members, essential for efficient water management. The ability to monitor peers enhances members' willingness to contribute to collective welfare, and the potential for punishment deters free-riders.

In kariz systems, community-based management of irrigation systems involves farmer stakeholders who make water allocation decisions based on expected crop payoff, influenced by available water, soil quality, and weather conditions. In contrast, aided systems involve government officials and aid agencies as main stakeholders who decide water allocation. Their decisions are influenced by political considerations, budget constraints, and development goals. Farmers have limited control and are motivated by water availability and crop prices.

Ostrom's principles for Common Pool Resource (CPR) management are highly applicable to the management of kariz systems. To begin with, the mirab system encapsulates the essence of collective decision-making, one of Ostrom's core principles. The community collectively selects a mirab who takes on the critical role of resolving water-related disputes and managing water allocation. This collective decision-making process aligns with Ostrom's principles by ensuring the accountability and involvement of local communities in managing their resources. Secondly, the mirab, through their responsibility for dispute resolution and water allocation, effectively serves as an accountable rule enforcer. The graduated sanctions for violations are often naturally integrated into community norms and practices. For instance, communities may impose social sanctions or withdraw resources from those who violate the agreed-upon rules. Thirdly, the kariz systems have built-in mechanisms for conflict resolution that are readily accessible to community members. The mirab serves as a point of contact for resolving disputes over water access or allocation. In more complex conflicts involving multiple communities, a shura with representatives from each convenes to make decisions. Ostrom's principle of the recognition of appropriators' autonomy by higher authorities is also evident. While there have been attempts to formalize the mirab system through draft laws, it remains largely a community-governed mechanism with local communities retaining significant autonomy over water management. Furthermore, Ostrom's concept of adaptive governance resonates strongly with the flexible, needs-based water allocation methods utilized in these systems. The rotational allocation system, called nawbat, adapts to water availability, thus exhibiting an impressive degree of adaptability and sustainability in governance.

The theoretical framework of this paper demonstrates that farmer incentives differ in kariz and water infrastructure aided systems. Kariz systems allow farmers to make decisions based on self-interest, while aided systems often limit farmer control over water allocation decisions, aligning their motivations with external factors such as water availability and crop prices.

Table 1: Impact of Irrigation Management Approach on Conflict Risk.

Condition	Approach	Interpersonal Dynamics	Transaction Costs	Conflict Risk
Drought/Flood	Traditional Kariz	Local Cooperation	Lower	Reduced
Drought/Flood	Aided Irrigation	Central-Local Discord	Higher	Increased

Data

This study relies on two complementary datasets to evaluate the impact of both large-scale top-down and small-scale bottom-up irrigation management systems in Afghanistan.

The first dataset amalgamates water infrastructure aid, conflict, and river line shapefile data, highlighting the locations of major aid-funded dams and conflict zones in Afghanistan. It specifically covers the Afghanistan Irrigation Restoration and Development Project (Project id P122235), which spanned 2011-2017 (AidData, 2017), and is sponsored and documented by the World Bank. Initiated in 2011 with World Bank support of US$146.20 million, the IRDP sought to enhance irrigation access and water management. This dataset also integrates data from the Armed Conflict Location and Event Data Project (ACLED), offering information about conflict events, locations, and intensities from 2017- 2021. The primary focus of this dataset is on top-down, large-scale irrigation projects. River line data is sourced from United States Geological Survey (Survey, 2023).

The second dataset originates from the Afghanistan Living Conditions Survey (ALCS), endorsed by the Central Statistical Organization (CSO). Previously known as the National Risk and Vulnerability Assessment (NRVA), this survey encompasses over 20,000 households and 157,000 individuals, including the nomadic Kuchi people. The ALCS collects year-round data, offering insights into diverse development indicators and emphasizing environmental challenges, especially water scarcity. This dataset primarily focuses on bottom-up, small-scale irrigation systems like the kariz.

The study's dependent variable is based on the socioeconomic questions within the ALCS survey. The geocoded dataset provides two waves of data (2014 and 2017), incorporating information on demographics, employment, agriculture, and more. The analysis specifically utilizes data on occupation, welfare, income, irrigation, external shocks, and employment decisions.

This study acknowledges the limitations of conflict data post-Taliban takeover, as well as the absence of individual data after 2017 as the wave of ALCS data post-2017 is held by the Taliban regime. However, this research attempts to complement the lack of individual data with conflict data from 2017-2021.

Data Analysis

This study provides empirical evidence on the effectiveness of infrastructure-based interventions, specifically irrigation systems, in conflict prevention. It employs a two-part analysis, using methodologies such as propensity score matching to deal with self-selection in Afghan Household Surveys.

The first part of the research analyses the Armed Conflict Location and Event Data Project (ACLED) data from 2017 to 2021, focusing on the AF Irrigation Restoration and Development Project. Utilizing R programming, a map of Afghanistan was generated to depict water infrastructure aid and conflict data points, including the location of large irrigation dams. The spatial analysis uncovered a notable correlation between conflict and proximity to rivers and irrigation projects: 96% of conflicts transpire near rivers and 4% near irrigation projects, implying a significant role of water resources and infrastructure development in conflict dynamics.

In the second part, the study delves into the Afghan Household Surveys from 2014 and 2017. Analysis of this data indicates that community-managed water systems, where local water users and community elders supervise irrigation and water distribution, are more effective than top-down strategies. Beneficiaries of these systems are less likely to partake in conflict. Moreover, certain types of aid projects such as dams near water bodies could potentially intensify conflicts, whereas specific systems such as deep well pumps, snowmelt, kariz, and spring water systems tend to alleviate them.

This research investigates the correlation between weather shocks and participation in military activities as a coping mechanism in Afghanistan. It employs "joining military activity" as a proxy for involvement in conflict, encompassing both the willingness to join formal armed forces like the Afghan army and the propensity to engage with insurgent groups. The study then furnishes empirical evidence on the effectiveness of infrastructure, particularly decentralized systems, in conflict prevention.

Case: The Irrigation Restoration and Development Project

This case study, based on extensive data, explores the potential relationship between conflict incidences in Afghanistan and the AF Irrigation Restoration and Development Project (IRDP), a World Bank-funded initiative. Using geo-referenced aid and conflict data, the study compares conflict level changes around project locations with control locations unaffected by the project. Results suggest the project could influence conflict dynamics, underlining the need for careful consideration of such development projects' spillover effects on local conflict. However, these findings require cautious interpretation due to potential confounding factors and spatial autocorrelation unaccounted for in this analysis. The study thus emphasizes the necessity for further research and calls on policymakers and water infrastructure aid organizations to incorporate conflict-sensitive approaches when designing and implementing similar projects.

The IRDP, implemented by Afghanistan's Ministry of Energy and Water (MEW), is a significant

initiative that began in 2011. It aimed to improve access to irrigation in targeted areas and enhance water resource management capacity with the support of the World Bank and a commitment of US$146.20 million.

The IRDP has worked extensively on rehabilitating irrigation systems and building infrastructure support like canals and dams. These efforts were aimed at optimizing water management, minimizing water loss, and ensuring year-round access to water resources for Afghan farmers. Reported outcomes suggest a notable improvement in agricultural productivity and a reduction in water-related conflicts.

Despite initial concerns about the IRDP's implementation and effectiveness, recent reports by the World Bank suggest remarkable success. In Nangarhar province, for example, the rehabilitation of irrigation systems has reportedly led to increased harvests and income for local farmers and significantly reduced water-related conflicts. These improvements in water management have benefited thousands of villagers, especially in Samarkhil village and the nearby areas of Araban and Saracha Alikhil.

Furthermore, the IRDP has successfully rehabilitated 98 irrigation systems spanning multiple provinces of Afghanistan. These systems cover 100,000 hectares of land and have benefitted over 63,000 farmers. The project, which received support from the International Development Association (IDA) and the Afghanistan Reconstruction Trust Fund (ARTF), has played a crucial role in building MEW staff capacity in water resource management.

Farmers have reported improvements in their agricultural practices and economic conditions, attributing these changes to the project. They've managed and utilized water more efficiently, diversified their crop cultivation, and consequently increased their income. Nevertheless, the IRDP remains a work in progress with room for further enhancements.

According to a World Bank report, the IRDP has demonstrated its potential by reducing water loss, decreasing water-related conflicts, boosting agricultural productivity, and uplifting Afghan farmers' livelihoods. These outcomes underscore the transformative power of well-managed irrigation systems in advancing rural economies in developing nations.

However, in stark contrast to these reported achievements, my research suggests a different conclusion. Utilizing the R programming language, I generated a map of Afghanistan illustrating water infrastructure aid and conflict data points, including the location of large irrigation dams. The map reveals a potential correlation between these dams and heightened conflict, possibly due to factors such as competition for water resources. Additionally, the study highlights the effects of the IRDP (Project id P122235) implemented from 2011 to 2017. This World Bank project, spread across 59 locations, focused on enhancing agricultural productivity and improving water resource management to boost food security, reduce poverty, and support local farmers' income. While data indicates successful implementation, there is insufficient information about the specific impact and outcomes, such as the number of beneficiaries or the extent of poverty reduction, necessitating a more detailed analysis for a comprehensive assessment of effectiveness.

The data table offers valuable insights into the relationship between rivers, irrigation projects under the AF Irrigation Restoration and Development Project (IRDP), and conflicts in Afghanistan. Across the country, 4,949 rivers and 59 irrigation projects were identified. The table also highlights a substantial 51,977 instances of conflict, demonstrating significant tensions in the region.

Notably, an overwhelming majority of conflicts, specifically 49,909 incidents or about 96% of all reported conflicts, occurred near rivers. Furthermore, the data shows a significant number of conflicts, tallying 22,639 instances, in proximity (10 and 20 kilometres) to the irrigation projects. This could suggest a potential association between the presence of water resources, development initiatives, and the occurrence of conflicts.

When observing conflict points in relation to both rivers and projects, a noteworthy discrepancy is

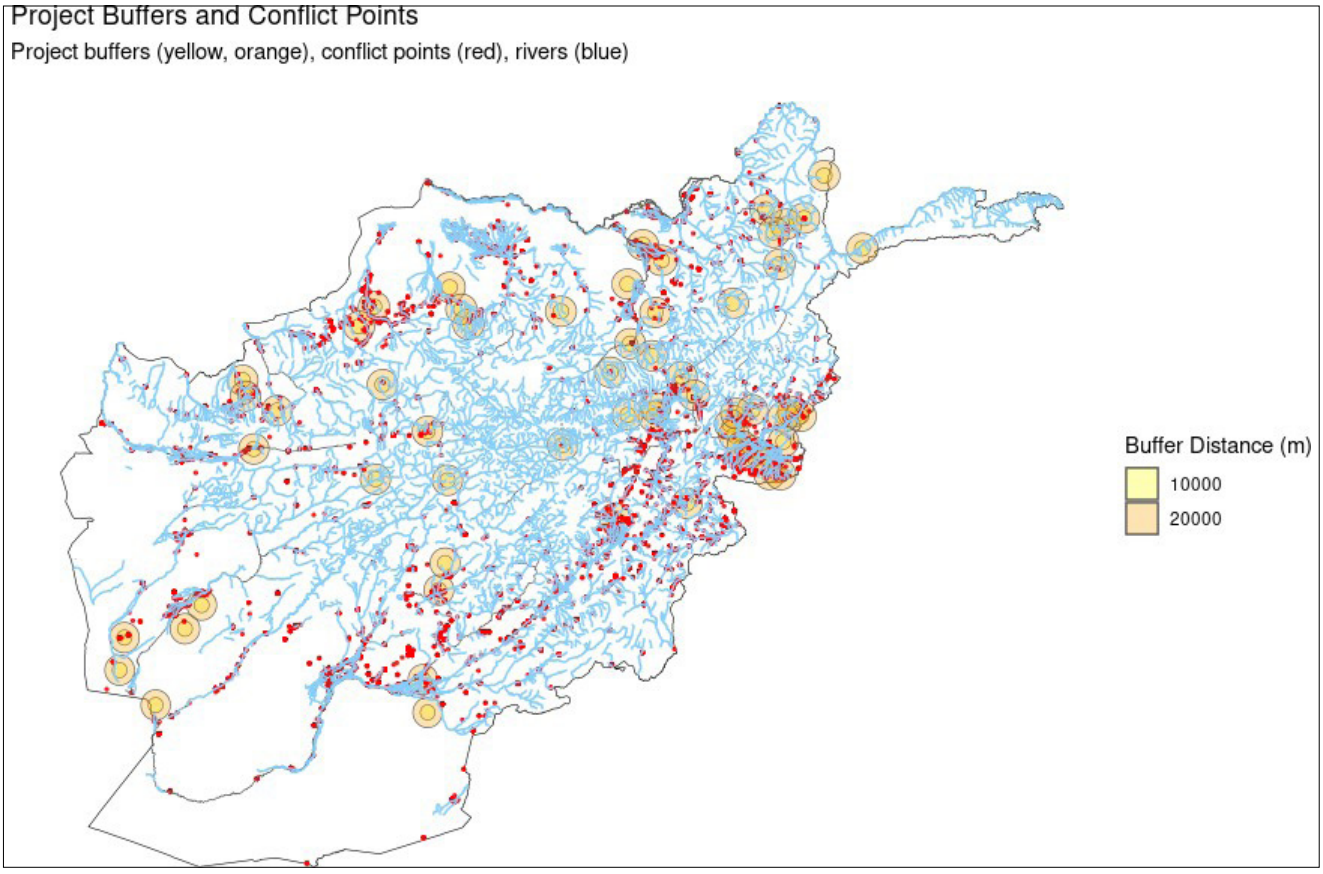

Figure 1: Afghanistan Irrigation Projects and Conflict

Source: World Bank Irrigation Restoration and Development Project (IRDP)
Armed Conflict Location and Event Data Project

apparent. Specifically, 14,922 conflicts occurred near both a river and a project site. However, a larger number of conflicts, 34,987 to be exact, were reported near a river but not within proximity to a project site. This discrepancy prompts questions regarding whether the presence of projects might influence conflict or if other, unconsidered factors are at play.

The data reveals that rivers with nearby projects experienced a higher mean conflict rate (302.2) compared to rivers without projects (214.5). This suggests a correlation between the presence of irrigation projects and heightened conflict. However, it's crucial to stress that correlation does not necessarily imply causation, and a more detailed research investigation follows in the next section

Thus, despite the laudable efforts of the IRDP to enhance agricultural productivity and water management, the data implies that their presence might coincide with a rise in conflicts, potentially due to disputes over water resources. Therefore, while the project may have achieved notable agricultural and economic successes, its overall impact on community stability may warrant further, more comprehensive investigation.

Table 2: Conflicts Near Rivers and Projects

	Count
Total rivers	4949
Total conflicts	51977
Total projects	59
Conflict points near the river	49909
Conflict points not near the river	2068
Conflict points near the project	22639
Conflict points not near the project	29338
Conflict points near both the river and the project	14922
Conflict points near the river but not the project	34987
Conflict points near the project but not the river	7717
Conflict points near neither the river nor the project	1827
Conflict points near rivers with projects	67996
Conflict points near rivers without projects	107473
Mean conflict points per river with a project	302.2044
Mean conflict points per river without a project	214.517

Source: World Bank Irrigation Restoration and Development Project (IRDP) Armed Conflict Location and Event Data Project

United States Geological Survey

Hypothesis Testing

This study provides further empirical evidence relevant to critical discussions on conflict prevention, specifically the efficacy of human intervention through infrastructure and the type of infrastructure (bottom-up vs. top-down) that can effectively prevent climate catastrophes and related conflicts. Unlike other conflict literature, this study utilizes individual-level surveys of households that have experienced weather shocks, irrigation system assistance, and conflict participation to evaluate the impact of public goods provision on conflict mitigation. Empirical methods include logistic regression and propensity score matching.

Increased extreme weather or climate hazards, such as winter storms, droughts, floods, and iceberg， can negatively impact agricultural production and exacerbate conflicts by lowering the opportunity cost of joining insurgent groups. Individuals who suffer property or job losses may be more likely to engage in conflict. Both short-term sudden catastrophes and long-term drought and flood disasters can adversely affect people in various ways. With irrigation systems, farmers become less susceptible to weather shocks and are more likely to secure employment.

The study explores whether the international community can contribute to conflict prevention through irrigation assistance. While irrigation systems can mitigate climate-driven conflict, local residents' self- governance plays a role in their contributions to public infrastructure compared to exogenous donations based on punishing defectors.

Bottom-up, community-based infrastructure projects are more effective in mitigating conflict, as they ensure the community's resilience to climate hazards. International community contributions to conflict prevention through infrastructure assistance should be designed in a way that complements and supports local self-governance mechanisms, rather than undermining or replacing them.

The study's analysis will further examine the interplay between infrastructure, self-governance, and conflict mitigation, as well as the role of the international community in fostering sustainable and resilient communities. By doing so, it aims to inform policy decisions and promote effective conflict prevention strategies in the context of climate change and its impacts on vulnerable populations.

- *Hypothesis 1*
  - *Individuals experiencing weather shocks (floods and droughts) are more likely to participate in conflict due to increased vulnerability and job loss, and reduced opportunity costs.*

- *Hypothesis 2*
  - *Community-based, traditional irrigation systems are more likely to reduce conflict risk for residents in surrounding areas, particularly during weather shocks (floods and droughts).*
  - *Externally-aided irrigation systems, particularly those that undermine or replace local self- governance, are more likely to increase conflict risk for residents in surrounding areas, particularly during weather shocks (floods and droughts).*

Regression and Propensity Score Matching

In this empirical study, I investigate the relationship between weather shocks and the inclination to participate in military activities in Afghanistan as a coping mechanism. My analysis indicates that individuals who have experienced weather shocks were more likely to engage in military activities. Intriguingly, proximity to various types of irrigation systems (such as dams and kariz)

appear to offer differing levels of protection or vulnerability in response to the impacts of weather shocks. I use the dependent variable "joining military activity" as a proxy for conflict involvement, which includes both the willingness to enlist in formal armed forces like the Afghan army and the tendency to align with insurgent groups. An elevated propensity to participate in military activities implies a higher inclination towards conflict. This finding suggests that the presence and type of irrigation infrastructure could considerably influence the effects of adverse weather events, either by mitigating or exacerbating their consequences.

To further investigate these relationships, I employed three methodological approaches. Firstly, I used logistic regression with fixed-effects controls to assess the impact of weather shocks on the likelihood of individuals engaging in military activities. This analysis is aimed at quantifying the degree to which adverse weather events influenced decisions to participate in conflict. Secondly, I conducted a separate logistic regression analysis, also with fixed-effects controls, to evaluate the mitigating or exacerbating effects of various irrigation systems on an individual's propensity to engage in conflict. This approach helped determine the role of different irrigation infrastructures in either reducing or increasing vulnerability to weather shocks, and the subsequent inclination towards military involvement.

Lastly, I utilized a propensity score matching technique, treating different irrigation systems as treatments and matching them with untreated individuals with similar demographic characteristics. This method allowed me to compare the potential impacts of weather shocks on conflict participation if the presence of various irrigation systems had offered varying degrees of protection or had exacerbated the effects.

The rationale for using "joining military activity" as a proxy is based on the premise that weather shocks can lead to adverse socioeconomic conditions, prompting individuals to seek alternative coping strategies. In Afghanistan, participation in military activities, whether within national armed forces or insurgent groups, can provide income, resources, and/or a sense of purpose amidst adversity. My analysis, therefore, focuses on how weather shocks influence the decision to engage in military activities, ultimately affecting conflict dynamics within the country, while underscoring the importance of irrigation systems in shaping these outcomes.

I estimate the following regression:

$$Military_{idt} = \beta_0 + \beta_1 shocks_{idt} + \chi + \theta_d + \gamma t + \epsilon_{idt} \quad (1)$$

$$Military_{idt} = \beta_0 + \beta_1 shocks_{idt} + \beta_2 irrigation_{idt} + \chi + \theta_d + \gamma t + \epsilon_{idt} \quad (2)$$

where $Military_{idt}$ is the outcome variable for person i in block d in year t. The outcome variable is a dummy variable if the individual has participated in the military or other rebel groups. $shock_{idt}$ is the dummy variable that the person has experienced shocks such as rain, natural disasters, or extreme conditions, and $irrigation_{idt}$ is a collection of dummy variables for people using different types of irrigation systems. All regressions control for year and region fixed effects. χ are control variables for demographic characteristics.

People's demographic backgrounds, including age, gender, income, education, region, and marital status, also influence their exposure to external shocks and access to irrigation assistance. Propensity score matching can somewhat mitigate this selection bias.

The results of the propensity score matching analysis, treating the irrigation system as the treatment group, are illustrated in the figure below. All other empirical findings are presented in the appendix tables. The graphic demonstrates the varying effectiveness of different irrigation systems in reducing the likelihood of individuals participating in conflict under identical weather conditions.

Logistic regression analysis offers insights into the impacts of all independent variables on the probability of joining military activities. The table suggests that unmarried men who are younger and have lower education levels exhibit a higher propensity to engage in conflict. Those who participated in military activities tended to have higher earnings. Natural disasters and weather shocks were found to increase the likelihood of warfare involvement; however, this effect was lessened when individuals had access to effective irrigation systems. The impact of various exogenous shocks, such as extreme weather, drought, heavy rains, violence, grazing, earthquakes, and opium eradication, all contributed to the likelihood of conflict engagement. The logistic regression results remained consistent when controlling for provincial fixed effects.

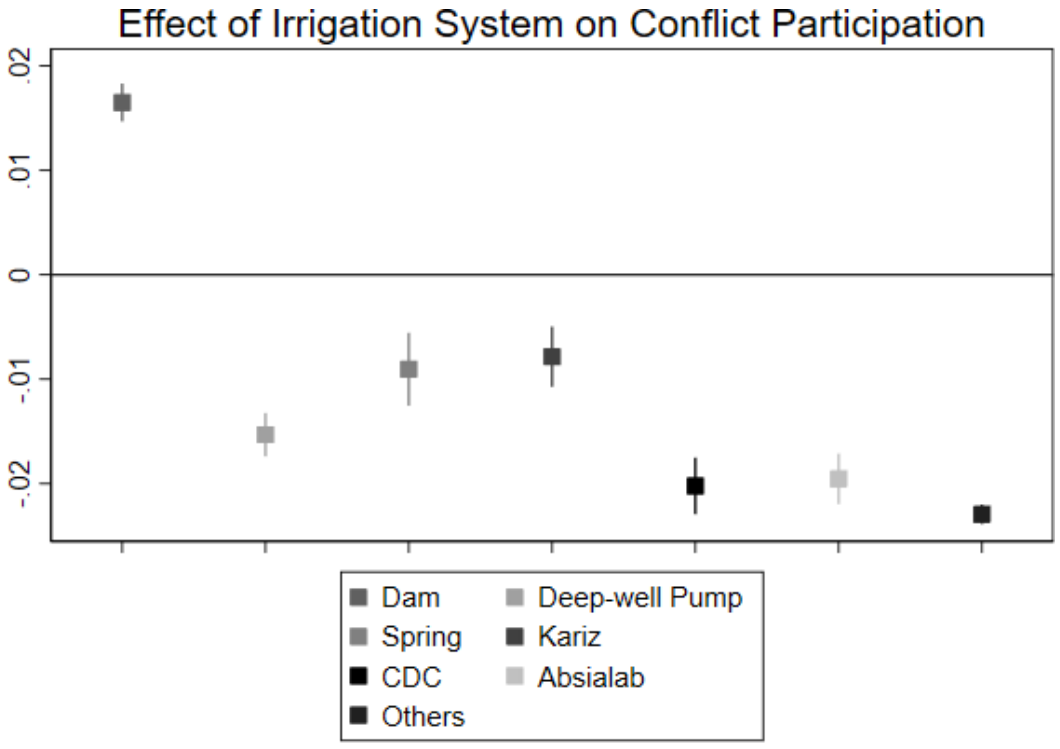

Figure 2: Coefficient Plot: Effect of Different Irrigation Systems on Conflict Participation
Source: Afghan Household Surveys

In the propensity score matching analysis, individuals with similar scores for age, gender, marital status, and education were matched, as shown in the third table. The fourth table incorporates

the income covariate, yielding consistent results across both tables. The treatments correspond to different irrigation systems, with the findings revealing that larger, centrally planned systems like irrigated rivers, canals, and dams were less effective in reducing conflict. In contrast, small-scale traditional irrigation systems such as deep well pumps, springs, kariz, nawara, and snowmelt, played a more crucial role in conflict mitigation.

Conclusion

This research covered an examination of the interaction between climate-induced shocks, public irrigation infrastructure, and conflict dynamics in Afghanistan, offering a more nuanced understanding of the situation than previously recognized. Through analysis of data from the Armed Conflict Location and Event Data Project (2017-2021) and Afghan Household Surveys (2014 and 2017), the study uncovers several findings.

Large-scale, externally-supported projects such as dams, which are widely implemented, have not been successful in preventing individuals from participating in armed conflict in response to climate shocks. In contrast, community-based practices such as the traditional kariz systems have proven successful in reducing conflict intensity by fostering social cohesion and fair resource distribution.

The research shows a noteworthy relationship between the location of conflicts and proximity to rivers and project sites. Rivers close to aid-driven irrigation projects, particularly those under the Afghanistan Irrigation Restoration and Development Project (IRDP), witnessed a higher average rate of conflict than those without such interventions. This finding suggests a potential correlation between these irrigation projects and heightened conflict, despite their commendable achievements in improving agricultural productivity and water resource management. An analysis of conflict points in relation to rivers and project sites reveals that a majority of conflicts occurred near rivers, with a significant number in proximity to the irrigation projects. Rivers with projects experienced a higher mean conflict rate compared to rivers without projects.

While the IRDP has produced agricultural and economic benefits, it may have inadvertently affected community stability by potentially escalating existing tensions. This association suggests that, while water infrastructure development projects like the IRDP can contribute to rural development, their implementation may also lead to unintended consequences, such as a rise in local conflicts.

This study included additional statistical analyses to deepen the understanding of the relationship between irrigation projects and conflict incidences. Using data from the Afghan Household Surveys (2014 and 2017), it explored the varying roles of different irrigation systems in conflict mitigation. This section of the study also underscores the significant impacts of the results of climate shocks, such as job or property loss, on the likelihood of individuals engaging in conflict. Such shocks frequently lead to socio- economic distress, making participation in military activities a viable coping strategy for those affected. The study found that top-down irrigation systems, such as government-management of rivers, canals, and dams, were less successful in moderating such conflict. In some

instances, these systems may have even exacerbated conflict. This was particularly true for systems that undermine or replace local self-governance, increasing the risk of individuals engaging in military activities, especially during weather shocks.

Conversely, bottom-up systems such as deep well pumps, snowmelt, kariz, springs, and community-driven projects proved more effective in mitigating conflict. These systems are more likely to reduce the risk of individuals participating in military activities, particularly during weather shocks like floods and droughts. The study also utilized propensity score matching to further support these conclusions. When individuals were matched based on similar demographic characteristics, those with access to small-scale traditional irrigation systems demonstrated a lower inclination towards conflict when confronted with weather shocks as compared to their counterparts who relied on larger, centrally planned systems.

This study underscores the importance of a conflict-sensitive approach in the design and implementation of irrigation systems, highlighting the pivotal role these systems play in conflict mitigation and peacebuilding. Furthermore, the study invites more in-depth exploration of global and regional environmental and water management strategies, assessing their potential to alleviate conflict.

The study urges policymakers and water infrastructure aid organizations to consider the potential spillover effects of their projects on local conflicts. Suggested measures include ensuring fair water distribution to prevent resource-driven conflicts, incorporating local community input and feedback into project planning, and providing training to local communities on the operation and maintenance of the project. These steps can significantly contribute to conflict prevention.

Essentially, this research offers two significant policy implications. First, it highlights the importance of environmental and water management strategies at both global and regional levels in contributing to conflict reduction. This suggests a need for policymakers to understand the complex interplay between environmental factors and conflict, enabling them to develop strategies aimed at reducing the adverse impacts of environmental changes on communities.

Second, it reinforces the idea that community-based interventions are more effective than externally imposed, top-down approaches in mitigating conflict and enhancing resilience. This implies a need for development organizations to shift their approach towards more localized, community-based solutions. These not only solve immediate issues but also empower communities for long-term resilience.

By integrating these findings into their strategies, policymakers and development organizations can significantly enhance the efficacy of their projects, enabling these stakeholders to implement effective water infrastructure and contribute towards creating a more peaceful and resilient society.

Appendix A: Table Outputs

Table 3: Descriptive Statistics

	mean	sd	min	max
age	20.17639	17.50167	0	98
sex	1.487867	.4998536	1	2
marital	3.533367	1.889468	1	5
educ attainment	.4730969	1.057495	0	7
irrigation	1.924251	1.447619	1	7
income	130361.1	154965.6	0	7000000
shock graze	.0786759	.2692327	0	1
shock weather	.1634233	.369752	0	1
shock natural disaster	.134175	.3408408	0	1
shock violence	.155377	.3622643	0	1
shock reduce water	.1070658	.3091978	0	1
shock flood	.1757131	.3805771	0	1
shock rain	.1535209	.36049	0	1
shock rains	.2623456	.4399109	0	1
shock eradication	.009907	.0990401	0	1
shock switch Op	.0065241	.0805085	0	1
shock opium	.0126795	.1118874	0	1
shock violence broader	.2345258	.4237034	0	1
shock drink water	.4107286	.4919676	0	1
military attend	.0133731	.1148664	0	1
N	312942			

Source: Afghan Household Surveys

Table 4: Logit: effect of irrigation system on conflict participation (2)

	(1) military	(2) military	(3) military	(4) military	(5) military	(6) military
age	0.0000265	-0.0000323	0.0000527	-0.0000258	0.00113	-0.00775***
	(0.01)	(-0.02)	(0.03)	(-0.01)	(0.47)	(-3.57)
sex	-0.0337	-0.0322	-0.0303	-0.0288	-0.0253	-0.122**
	(-0.92)	(-0.88)	(-0.83)	(-0.79)	(-0.51)	(-2.78)
marital	-0.00293	-0.00315	-0.00155	-0.00188	0.0165	-0.0442*
	(-0.19)	(-0.20)	(-0.10)	(-0.12)	(0.77)	(-2.31)
education	0.0904***	0.0823***	0.0824***	0.0732***	0.0862***	-0.0226
	(5.04)	(4.55)	(4.58)	(4.03)	(3.40)	(-0.92)
income		0.000000414***		0.000000480***	0.000000445***	0.00000108***
		(6.16)		(6.58)	(5.86)	(17.77)
shock natural disaster	1.158***	1.157***			1.604***	
	(18.82)	(18.82)			(18.97)	
shock weather			0.454***	0.467***		1.635***
			(8.23)	(8.46)		(33.68)
irrigation					-0.00132	-0.330***
					(-0.05)	(-14.89)
fixed effect controlled	controlled	controlled	controlled	controlled	controlled	controlled
N	182604	182110	182604	182110	51554	96686

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Afghan Household Surveys

Table 5: Logit: effect of irrigation system on conflict participation (2)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	military	military	military	military	military	military	military
shock	weather	eradication	rain	rains	graze	violence	violence broader
shock	2.021***	1.079***	1.745***	0.945***	1.337***	1.364***	0.945***
	(54.74)	(10.29)	(29.45)	(14.64)	(38.45)	(19.50)	(12.95)
age	-0.00617***	-0.00830***	-0.00682***	-0.00736***	-0.00429*	-0.00843***	-0.00174
	(-3.85)	(-4.99)	(-3.98)	(-4.64)	(-2.53)	(-5.06)	(-0.32)
sex	-0.101**	-0.121***	-0.0976**	-0.106**	-0.122***	-0.122***	-0.0686
	(-3.06)	(-3.62)	(-2.83)	(-3.25)	(-3.56)	(-3.63)	(-0.49)
marital	-0.0389**	-0.0519***	-0.0473**	-0.0452**	-0.0232	-0.0532***	0.00262
	(-2.73)	(-3.53)	(-3.11)	(-3.21)	(-1.53)	(-3.61)	(0.06)
educ attainment	-0.0109	-0.0456**	0.0161	-0.0290	-0.0136	-0.0413*	-0.0792
	(-0.64)	(-2.58)	(0.90)	(-1.71)	(-0.78)	(-2.34)	(-1.18)
income	0.000000845***	0.000000683***	0.000000754***	0.000000748***	0.000000733***	0.000000682***	0.00000250***
	(19.61)	(16.22)	(17.36)	(17.69)	(16.75)	(16.23)	(6.39)
fixed effect	provincial	provincial	provincial	provincial	provincial	provincial	provincial
N	239616	156980	156980	239616	156980	156980	82636

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Afghan Household Surveys

Table 6: Logit: effect of irrigation system on conflict participation (2)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	military	military	military	military	military	military	military
shock	weather	eradication	Rain	rains	graze	violence	violence broader
shock	1.683***	0.582***	1.645***	1.199***	1.384***	0.860***	1.704***
	(35.03)	(4.63)	(23.15)	(26.17)	(14.02)	(10.86)	(9.73)
irrigation	-0.352***	-0.404***	-0.321***	-0.383***	-0.425***	-0.406***	-0.173*
	(-16.08)	(-16.84)	(-14.16)	(-17.19)	(-17.07)	(-16.95)	(-2.33)
age	-0.00818***	-0.0121***	-0.00931***	-0.0103***	-0.00749**	-0.0122***	0.00317
	(-3.80)	(-5.36)	(-4.02)	(-4.81)	(-3.24)	(-5.41)	(0.46)
sex	-0.132**	-0.144**	-0.108*	-0.133**	-0.146**	-0.143**	-0.179
	(-3.03)	(-3.25)	(-2.35)	(-3.07)	(-3.21)	(-3.22)	(-0.98)
marital	-0.0468*	-0.0752***	-0.0606**	-0.0584**	-0.0430*	-0.0752***	0.0805
	(-2.47)	(-3.82)	(-2.97)	(-3.12)	(-2.11)	(-3.83)	(1.31)
educ attainment	-0.0324	-0.0406	0.00714	-0.0621*	-0.0134	-0.0448	-0.173
	(-1.33)	(-1.64)	(0.28)	(-2.57)	(-0.54)	(-1.81)	(-1.73)
income	0.00000112***	0.00000103***	0.000000930***	0.00000107***	0.00000109***	0.00000103***	0.00000304***
	(19.02)	(17.77)	(16.45)	(18.70)	(18.41)	(17.82)	(5.51)
fixed effect	district	district	District	district	district	district	district
N	101225	67657	67657	101225	67657	67657	33568

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Afghan Household Surveys

Table 7: PSM: effect of irrigation system on conflict participation

	Dam	Deep-well	Spring	Kariz	CDC	Absialab	Other
PSM1	0.0168***	-0.00851***	-0.0135***	-0.00577***	-0.0215***	-0.0202***	-0.0229***
t	19.10	-6.61	-11.28	-3.75	-23.11	-18.83	-48.70
PSM2	0.0165***	-0.0153***	-0.00904***	-0.00784***	-0.0202***	-0.0195***	-0.0229***
t	17.84	-14.40	-5.07	-5.34	-14.60	-15.87	-48.70
N	101471 / 101225						

Source: Afghan Household Surveys

Table 8: PSM: effect of weather shock on conflict participation

	(1) military	(2) military
ATE		
r1vs0.shock weather	0.0494***	0.0541***
	(43.51)	(41.59)
income	unmatched	matched
N	240269	239615

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Source: Afghan Household Surveys

Appendix B: NWARA Projects

Below is a list of notable NWARA projects which focus on water resource management, agricultural land expansion, and local community benefits:

- **Deyagub Canal Project, Baghlamy District, Kabul Province:** Implemented by NWARA, this project's goal is to manage water resources and expand agricultural land in the Bagrami District. Upon completion, an 8-kilometer riser will irrigate about 985 hectares of farmland, benefiting approximately 5,680 households.
- **Shkaman Canal Construction, Laghman Province:** In collaboration with the World Food Programme, NWARA is executing this project in the Alisheng District. The project has irrigated 300 hectares of farmland, directly benefiting 500 households. During implementation, 450 people were employed.
- **Shamshpur Canal, Noh Nak Province:** This project prevents water waste and increases cultivated land in the Shukrud area. After the construction of the canal, irrigated farmland expanded from 1,229 hectares to 1,504 hectares, benefiting around 21,980 people.
- **Abdul Rahimzai Canal, Farah Province:** This canal has irrigated nearly 20,000 hectares of farmland, benefiting 5,000 families. It contributes to water source management, farmland water supply, and flood control in Farah province.
- **Nasrat Canal and River Embankment Project, Badghis Province:** The 36-kilometer-long Nasrat Canal irrigates about 5,000 hectares of farmland for 4,300 households. The successful completion of the river embankment project continues to benefit farmers with improved irrigation in Bamyan province.

These projects demonstrate NWARA's commitment to sustainable water management and improving the livelihoods of local communities.

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